DRAFT

Recovery Plan for
Oregon's Middle Columbia River Steelhead

Progress Report

January 17, 2006

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Section 2 Introduction

This document is an early draft of a recovery plan that identifies the conditions that have led to the listing of the Middle Columbia (Mid-Columbia) River steelhead (*Oncorhynchus mykiss)* as a threatened species, and to the designation of critical habitat, under the Endangered Species Act (ESA) of 1973 (as amended). This initial effort is an early draft recovery framework, or progress report, intended to keep the interested reader abreast of the development of the draft plan. When the full draft recovery plan is ready, an extensive review will occur and the draft will be revised. The agencies will encourage review from government agencies, non-governmental organizations, landowners, interested public, and other stakeholders. Since the Middle Columbia steelhead ESU covers two states, the Oregon draft recovery plan will be "rolled up" with Washington draft recovery plans into a final plan for the entire Middle Columbia steelhead ESU by the end of 2006.

This draft plan describes a process to remove or minimize the threats to the long-term survival and recovery of Mid-Columbia River steelhead and improve the viability to the level that protection under the ESA is not required. When completed this document will describe:

- The institutional framework and rationale for writing recovery plans
- How NOAA's National Marine Fisheries Service (NMFS) expects to use the plans
- The regional domains of the Columbia Basin within which the recovery plans are written
- The relation of this plan to other planning processes and other ESA mandates
- Desired status--viability and broad sense recovery
- The current status of listed Mid-Columbia River steelhead
- Gaps between current status and viable status
- Recovery goals and strategy for the Oregon portion of Mid-Columbia River steelhead
- Management actions and expected outcomes
- Estimate of time and costs
- A framework for implementation and adaptive management

2.1 Species Recovery Under ESA

Section 4(f) of the ESA requires that a recovery plan be developed and implemented for species listed as endangered or threatened under the statute. These plans must, at a minimum, contain (1) a description of site-specific management actions necessary to achieve the plan's goal for the conservation and survival of the species; (2) objective, measurable criteria which, when met, would result in a determination that the species be removed from the list; and (3) estimates of the time required and cost to carry out the measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal. Although the plans are guidance and not regulatory documents, the authors of the ESA clearly saw recovery plans as a central organizing tool for the recovery of listed species.

NMFS is the agency responsible for recovery planning for anadromous salmonids, and is also responsible for the decision to list and delist marine species as endangered or threatened. NMFS has found that local support of recovery plans is essential to their successful implementation and, therefore, is committed to involving local citizens and groups in development of the plans. The State of Oregon has taken the lead, in collaboration with NMFS and many other agencies, in development of the recovery plan for Oregon Mid-Columbia River steelhead.

A recovery plan is a road map for listed species recovery and describes a process to remove the threats to the long-term survival by reversing the decline of a listed species and its habitat. In this plan, recovery is generally defined as the restoration of listed species such that they initially become viable. A recovery plan provides the necessary information that federal agencies (NOAA Fisheries and the U.S. Fish and Wildlife Service) have determined will lead to recovery of listed species and their associated habitats. The plan describes the current species status, the "gap" that needs addressing to reach recovery, as well as ongoing or proposed actions designed to aid in the recovery of the species. The plan will also provide estimated timeframe and costs for the overall effort.

Once a species is deemed recovered and therefore removed from a "listed status," section 4(g) of the ESA requires the monitoring of the species for a period of not less than five years to ensure that it retains its recovered status and does not decline to such a state that requires the need to again list it as either a threatened or endangered species under the ESA.

2.2 State of Oregon Recovery Planning

The State of Oregon's approach to recovering the Mid-Columbia River steelhead includes not only achieving ESA recovery requirements, but also embraces achievement of specific "broad sense recovery goals," including meeting social and cultural benefits. This approach to species recovery includes development of specific broad sense recovery goals for harvestable population levels viewed essential by all the parties involved. Although somewhat broader than the definition of recovery provided by the ESA, these broad sense recovery goals incorporate many of the traditional uses as well as rural and Native American values deemed important in the Pacific Northwest.

2.3 Tribal Treaty/Trust Obligations

Northwest Indian tribes have legally enforceable treaty rights reserving to them a share of the harvestable salmon. Achieving the basic purposes of the ESA such that the species no longer needs the protection of the Act may not by itself fully meet these rights and expectations, although it will lead to major improvements in the current situation. Ensuring a sufficient abundance of salmon to sustain harvest can be an important element in fulfilling trust and treaty rights, as well as garnering public support for recovery plans.

Several treaty tribes live within the range of Mid-Columbia River steelhead; they include the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon. The Treaty of June 9, 1855 was signed between the United States and the Walla Walla, Cayuse, and Umatilla Tribes (now the Confederated Tribes of the Umatilla Indian Reservation). In 1855, the Warm Springs and Wasco Tribes also signed a treaty with the United States, known as the

Treaty with the Middle Oregon Tribes. The Confederated Tribes of the Warm Springs are the Warm Springs, Wasco, and Paiute Tribes. The Confederated Tribes and Bands of the Yakama Nation represent fourteen tribes and bands that were included in the Treaty with the Middle Oregon Tribes.

Thus, it is appropriate for recovery plans to take these considerations into account and plan for a recovery strategy that includes harvest. In some cases, the desired abundances for harvest may come about through increases in the naturally spawning population. In others, the recovery strategy may include appropriate use of hatcheries to support a portion of the harvest. So long as the overall plan is likely to achieve the biological recovery of the listed ESU, it will be acceptable as a recovery plan.

Section 3 Background--Middle-Columbia River Steelhead ESU

3.1 Context of Plan Development

Currently there are 17 ESUs of Pacific salmon and steelhead listed throughout Washington, Oregon, and Idaho; these fall within five geographic recovery domains. The five domains are the Interior Columbia (which is divided into three sub-domains: the Snake River, Mid-Columbia, and Upper Columbia); the Willamette-Lower Columbia; Puget Sound and Washington Coast; the Oregon Coast; and the Southern Oregon/ Northern California Coast.

For each domain, NMFS appointed an independent Technical Recovery Team (TRT) that has geographic and species expertise for the domain and can provide a solid scientific foundation for recovery plans. The charge of each TRT is to define ESU structures, develop recommendations on biological viability criteria for ESUs and populations, to provide scientific support to local and regional recovery planning efforts, and to provide scientific evaluations of recovery plans. The TRTs include biologists from NMFS, state, tribal, and local entities, agencies, academic institutions, and private consulting groups. Each TRT has used the same biological principles for developing its recommended ESU and population viability criteria -- criteria that will be used, along with threats-based criteria, to determine whether a species has recovered sufficiently to be downlisted to threatened (if endangered) or delisted -- although they have developed regionally specific approaches to these criteria. Viability criteria are expressed in terms of abundance, productivity (population growth rate), spatial distribution, and diversity (McElhany et al. 2000).

In each domain, NMFS has worked with state, tribal, local and other federal agencies to develop a planning forum appropriate to the domain, which builds to the extent possible on ongoing, locally led efforts. For the Oregon portion of the Middle Columbia ESU, the Oregon Department of Fish and Wildlife (ODFW) has taken the lead in preparing a plan. ODFW has established a Recovery Planning Team that includes state, tribal, and federal. In addition, NOAA has established a local forum, the Mid-Columbia Sounding Board (MCSB). Membership of the MCSB consists of local representatives of communities, Soil and Water Conservation Districts, Watershed Councils, farmers, ranchers, subbasin planners, irrigation districts, and industry and environmental interests. The role of the MCSB planning forum is to use TRT and other technical products to develop locally appropriate and locally supported recovery actions needed to achieve species recovery goals. These plans are intended to be scientifically sound, based on local efforts, and realistic road maps to species recovery.

For more information about NMFS, the NPCC, the domains, and the TRTs, see the following Internet sites:
http://www.nwr.noaa.gov
http://www.nwr.noaa.gov/Salmon-Recovery-Planning/index.cfm
http://www.nwcouncil.org/
http://www.nwfsc.noaa.gov/trt/trt_columbia.htm

The draft framework for the recovery plan focuses on that portion of the range of Mid-Columbia River steelhead within the State of Oregon. The State of Washington took responsibility for recovery planning for the portion of the Snake River Basin within its borders. The State of Washington's Salmon Recovery Act established six regional boards that comprise government and tribal representatives, landowners, and private citizens. With substantial funding from Salmon Recovery Board and Northwest Power and Conservation Council, these groups produced the June 2005 *Draft Snake River Salmon Recovery Plan for SE Washington*, and the October 2005 *Draft Yakima Subbasin Salmon Recovery Plan*, which address the drainages within the State of Washington regarding Mid-Columbia River steelhead.

The draft Mid-Columbia River steelhead recovery plan will be posted on the NMFS web site (http://www.nwr.noaa.gov/Salmon-Recovery-Planning/index.cfm) to provide an opportunity for informal public response during the development phase.

Once this recovery plan is approved, all federal and nonfederal funding entities should develop a coordinated, prioritized, and accountable funding strategy. To facilitate implementation, NOAA intends to provide regulatory assurances for actions that are undertaken to implement recovery. Whether NMFS will provide regulatory assurances on the basis of a recovery plan depends on several factors:

- The Plan's comprehensiveness, level of detail, and likelihood of achieving desired results
- Comprehensiveness and certainty of commitments for implementation
- Demonstrated progress in implementation of actions called for in the Plan
- Improved status and trends for populations of the listed species

As we implement recovery, monitoring, research and evaluation will have to be high priorities. Adjustments to on the ground actions in response to new information will be incorporated as we learn. The challenges of salmon recovery are immense, particularly in the face of increasing human populations and heavy demand for precious resources such as sufficient clean water. It will be important to monitor the benefits and costs of completed actions and to work in a collaborative forum to tackle the hard issues to come.

3.2 Overview of Recovery Goals

A simplified way of looking at species recovery includes addressing those factors which lead to the species being listed. Section 4(a)(1) of the ESA and NMFS' implementing regulations (50 CFR part 424) set forth procedures for listing species. The Secretary of Commerce (Secretary) must determine, through the regulatory process, if a species is endangered or threatened because of any one or a combination of the following factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors affecting its continued existence. NMFS has previously detailed the impacts of various factors contributing to the decline of Pacific salmon and *O. mykiss* (e.g., citations for ESU listing determinations; NMFS 1997c, ''Factors Contributing to the Decline of Chinook Salmon—An Addendum to the 1996 West Coast Steelhead Factors for Decline Report;'' NMFS 1996a, ''Factors for Decline—A Supplement to the Notice of Determination for West Coast Steelhead Under the Endangered Species Act''). The Federal Register notices and technical reports concluded that all of the factors identified in section 4(a)(1) of the ESA have played a role in the decline of West Coast salmon and *O. mykiss* ESUs. The Federal Register notices and technical reports provide a more detailed treatment of the relevant factors for decline for specific ESUs. The following discussion briefly summarizes findings regarding the principal factors for decline across the range of West Coast salmon and *O. mykiss*. While these factors are treated in general terms, it is important to underscore that impacts from certain factors are more acute for specific ESUs.

1. *The present or threatened destruction, modification, or curtailment of its habitat or range:* West Coast salmon and *O. mykiss* have experienced declines in abundance over the past several decades as a result of loss, damage or change to their natural environment. Water diversions for agriculture, flood control, domestic, and hydropower purposes have greatly reduced or eliminated historically accessible habitat and degraded remaining habitat. Forestry, agriculture, mining, and urbanization have degraded, simplified, and fragmented habitat. Studies indicate that in most western states, about 80 to 90 percent of the historical riparian habitat has been eliminated (Botkin et al., 1995). The destruction or modification of estuarine areas has resulted in the loss of important rearing and migration habitats. Losses of habitat complexity and habitat fragmentation have also contributed to the decline of West Coast salmonids. Sedimentation from extensive and intensive land use activities (e.g., timber harvests, road building, livestock grazing, and urbanization) is recognized as a primary cause of habitat degradation throughout the range of West Coast salmon and *O. mykiss*.

   Depending upon the their natal watershed, adults and out-migrating juveniles steelhead encounter between one and three Mainstem Columbia River dams migrating to and from the ocean. Hydroelectric development has modified natural flow regimes resulting in higher water temperatures, changes in fish community structure, and increased travel time for migrating adults and juvenile salmonids. Physical features of dams such as turbines also kill migrating fish. The only substantial habitat blockages at present in this ESU are Pelton Dam on the Deschutes River and Condit Dam on the White Salmon

River. However, minor blockages from smaller dams, impassable culverts, irrigation dams, *etc*. occur throughout the region.

2. *Overutilization for commercial, recreational, scientific, or educational purposes*: Historically, salmon and *O. mykiss* were abundant in many western coastal and interior waters of the United States. These species have supported, and continue to support, important tribal, commercial and recreational fisheries throughout their range, contributing millions of dollars to numerous local economies, as well as providing important cultural and subsistence needs for Native Americans. Overfishing in the early days of European settlement led to the depletion of many stocks of salmonids, prior to extensive modifications and degradation of natural habitats. However, following the degradation of many west coast aquatic and riparian ecosystems, exploitation rates were higher than many populations could sustain. Therefore, harvest may have contributed to the further decline of some populations.

   Steelhead harvest or fishery impact occurs in Columbia River and tributaries sport fisheries, Columbia River Treaty Indian gillnet fisheries, Columbia River Treaty Indian subsistence fisheries, and tributary Treaty Indian subsistence fisheries. Landing records and coded wire tag analyses indicate that steelhead are not taken in significant numbers in any ocean fishery, apparently because of an offshore, high-seas distribution pattern. Non-Indian commercial fisheries for steelhead in the Columbia River have been prohibited beginning in 1975 and incidental impacts of non-Indian commercial fisheries for other species are minimal because no significant fisheries occur in the group A (see Life History section below) migration time frame.

   Columbia River sport fisheries above and below Bonneville Dam keep only marked (hatchery) fish since the late 1970's. Significant sport fisheries for steelhead between Bonneville Dam and the Deschutes River occur primarily from July through September when fish seek refuge from warm Columbia River temperatures in cool tributary mouths, primarily in Bonneville Reservoir. Steelhead are taken by treaty Indian fisheries in the Columbia River mainstem primarily in fall gillnet fisheries which target Chinook salmon from late August through October. Current steelhead harvest rates in fall treaty Indian fisheries are limited in number and through the use of large mesh gillnets, which target the larger fall Chinook. Small numbers of steelhead are also taken in various ceremonial and subsistence fisheries during the remainder of the year. These fisheries primarily occur by hook-and-line or from platforms with dip nets. Treaty Indian fisheries occur from Bonneville to McNary dams but most of the effort is between Bonneville Dam and the Deschutes River mouth.

   Steelhead harvest or fishery impact also occurs in the Deschutes Basin sport and tribal dipnet fisheries (which occurs immediately below Sherars Falls in years when fall salmon runs are significant). The required release of wild fish, catch of many non-local fish, and the reliance on catch record card data for catches above Sherars Falls make estimation of fishery impacts on wild Deschutes River steelhead difficult.

3. *Disease or predation***:** Introductions of non-native species and habitat modifications have resulted in increased predator populations in numerous rivers and lakes. Predation by seabirds can influence the survival of juvenile salmon and *O. mykiss* in some locations. For example, it is estimated that Caspian terns (*Sterna caspia*) in the lower Columbia River and estuary consume approximately 13 percent of the outmigrating smolts reaching the estuary in some years (Collis et al., 2001). Other mainstem predation occurs from walleye (*Stizostedion Vitreum*) and California sea lions (*Zalophus californianus*) of juveniles and adults, respectively.

   Infectious disease is one of many factors that can influence adult and juvenile salmon and *O. mykiss* survival. In general, very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases. Native *O. mykiss* populations have co-evolved with specific communities of these organisms, but the widespread use of artificial propagation has introduced exotic organisms not historically present in a particular watershed. Habitat conditions such as low water flows and high temperatures can exacerbate susceptibility to infectious diseases.

4. *The inadequacy of existing regulatory mechanisms*: The ESA listings of salmon and *O. mykiss* ESUs have provided the incentive for numerous protective efforts. While many causes of decline in salmon and *O. mykiss* ESUs are being addressed (e.g., providing fish passage above artificial barriers), habitat degradation and destruction have been slowed but not prevented. The protective efforts are directed toward addressing the numerous factors that adversely impact Mid-Columbia River steelhead and its habitat — water quality and quantity, safe migration, riparian vegetation, food, predation dynamics and complex stream channels, and floodplain connectivity. These actions all will aid in improving these factors within the area of each project. The recovery planning process addresses the cumulative effects of these and other protective efforts, and any additional measures necessary to address the species' factors for decline and extinction risk.

5. *Other natural or manmade factors affecting its continued existence*: Variability in ocean and freshwater conditions can have profound impacts on the productivity of salmon and *O. mykiss* populations. Natural climatic conditions have at different times exacerbated or mitigated the problems associated with degraded and altered riverine and estuarine habitats. Extensive hatchery programs have been implemented throughout the range of West Coast salmon and *O. mykiss*. Artificial propagation may play some role in salmon and *O. mykiss* recovery. The state natural resource agencies (ODFW, Idaho Department of Fish and Game, and the Washington Department of Fish and Wildlife) have adopted or are implementing natural salmonid policies designed to ensure that the use of artificial propagation is conducted in a manner consistent with the conservation and recovery of natural, indigenous salmon and *O. mykiss* stocks.

   Water quality impairment that affects spawning, migration and rearing is a problem in many areas of designated critical habitat for Mid-Columbia River steelhead. Summer stream temperature is the primary water quality problem for this ESU, and many of the stream reaches designated as critical habitat are listed on the Clean Water Act (CWA)

303(d) list for water temperature. Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures. Elevated stream temperatures may form thermal barriers to juvenile migration within tributaries. Removal of riparian vegetation, alteration of natural stream morphology, and water withdrawal for agricultural or municipal use all contribute to elevated stream temperatures. Contaminants such as insecticides and herbicides from agricultural run-off and heavy metals from mine waste are common in some areas of designated critical habitat for this ESU.

Low summer streamflows are also a common characteristic affecting spawning, rearing, and migration. Withdrawal and storage of natural stream flow in spawning and rearing areas have altered hydrological cycles, causing a variety of adverse impacts to Mid-Columbia River steelhead habitat. Increased summer stream temperatures, migration blockages, stranding of fish, and alteration of sediment transport processes can result from water withdrawal for irrigation or municipal use (NMFS 1996; Spence et al. 1996). In many river basins, the amount and quality of available rearing habitat have been reduced by water withdrawals. Many stream reaches are over-appropriated under state water law, with more allocated water rights than existing streamflow conditions can support.

Spawning and rearing steelhead require physically complex lotic habitats with pools, large woody debris, undercut banks, and substrates with low levels of fine sediments (Spence et al. 1996; Bjornn and Reiser 1991). Although these habitat conditions are still present in many areas, large-scale assessments (McIntosh et al. 1994) and recent subbasin assessments and plans (NWPCC 2004) indicate that habitat complexity has been greatly reduced in many areas. Channel and riparian alterations for agricultural purposes, transportation, mining, forestry and other development activities have affected freshwater life stages by reducing overall habitat complexity, cover, food availability, and spawning and rearing quality and quantity.

3.3 Description and Taxonomy

The Mid-Columbia River steelhead were listed as threatened on March 25, 1999 [64 FR 14517]. Protective regulations for Mid-Columbia River steelhead were issued under section 4(d) of the ESA on July 10, 2000 (65 FR 42422). The Mid-Columbia River steelhead listing was developed in response to a biological review which concluded summer steelhead in the Mid-Columbia River ESU were "likely to become endangered in the foreseeable future" (NMFS 1999).

The most prominent factors leading to NMFS' conclusion that Mid-Columbia River steelhead were threatened included: (1) declines in abundance of wild steelhead populations, (2) levels of abundance well below historic levels, (3) large numbers of hatchery-origin steelhead entering the Deschutes River basin, and a lack of information regarding this phenomenon, (4) large numbers of hatchery steelhead relative to wild steelhead, and a general lack of information regarding the impacts of hatchery steelhead on wild steelhead populations throughout the region, (5) a lack of information regarding the interactions between resident rainbow trout and anadromous steelhead, and (6) habitat alterations in the region resulting in a loss of spawning and rearing habitat for steelhead, including habitat changes which have exterminated some steelhead runs (Busby et al. 1996; NMFS 1999).

The Mid-Columbia River steelhead ESU includes all natural populations of steelhead in streams within the Columbia River basin from above the Wind River in Washington and the Hood River in Oregon (exclusive), upstream to, and including, the Yakima River in Washington, excluding steelhead from the Snake River Basin (64 FR 14517; March 25, 1999). Resident populations of *O. mykiss* below impassible barriers (natural and manmade) that co-occur with anadromous population are currently included in the Mid-Columbia River steelhead ESU (69 FR 33101; June 14, 2004); however, NMFS has proposed to remove resident fish from the listed ESU. The ESU membership of native resident populations above recent (usually man-made) impassable barriers, but below natural barriers, is not resolved. These resident populations are provisionally not considered to be part of the Mid-Columbia River steelhead ESU, until such time that significant scientific information becomes available affording a case-by-case evaluation of their ESU relationships.

Mid-Columbia River steelhead historically occupied nine major river systems within the states of Oregon and Washington on the east side of the Cascades Mountains (Figure 3-1) and numerous minor systems. These major tributaries to the Columbia River include the White Salmon, Fifteenmile Creek, Deschutes, John Day, Klickitat, Rock Creek, Umatilla, Walla Walla, and Yakima River systems. The John Day River of central Oregon probably represents the largest naturally spawning, native group of steelhead in the region.

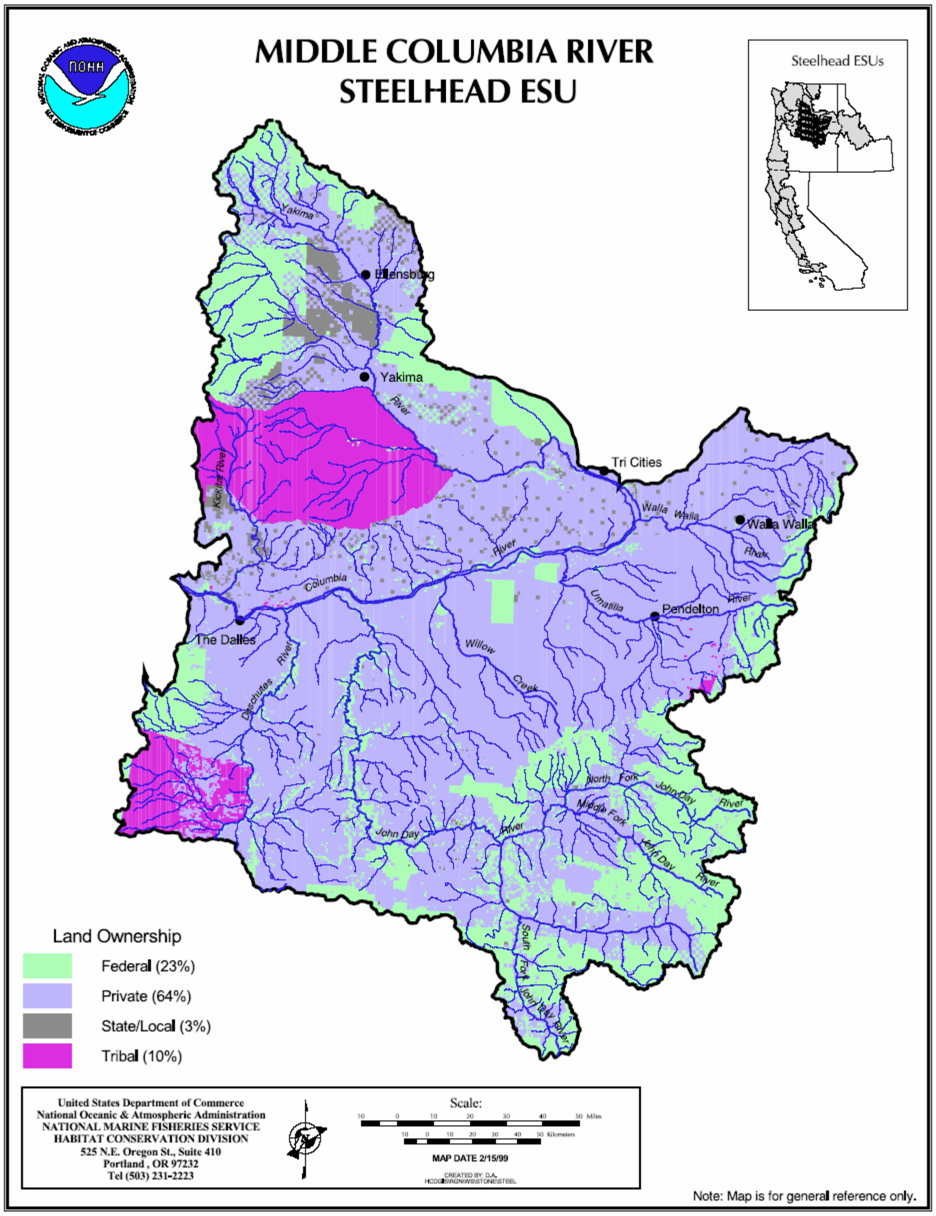

Figure 3-1. Geographic boundaries of the Mid-Columbia River Steelhead ESU.

The Interior Columbia Basin Technical Recovery Team (TRT) (2003) identified 20 historic populations in four major population groups (Cascades Eastern Slope Tributaries, John Day River, the Umatilla and Walla Walla Rivers, and the Yakima River). There are 17 extant populations. There are two extinct populations in the Cascades Eastern Slope major population group (MPG): the White Salmon River and Deschutes Crooked River above Pelton Dam; and, one extinct population in the Umatilla/Walla Walla MPG: Willow Creek.

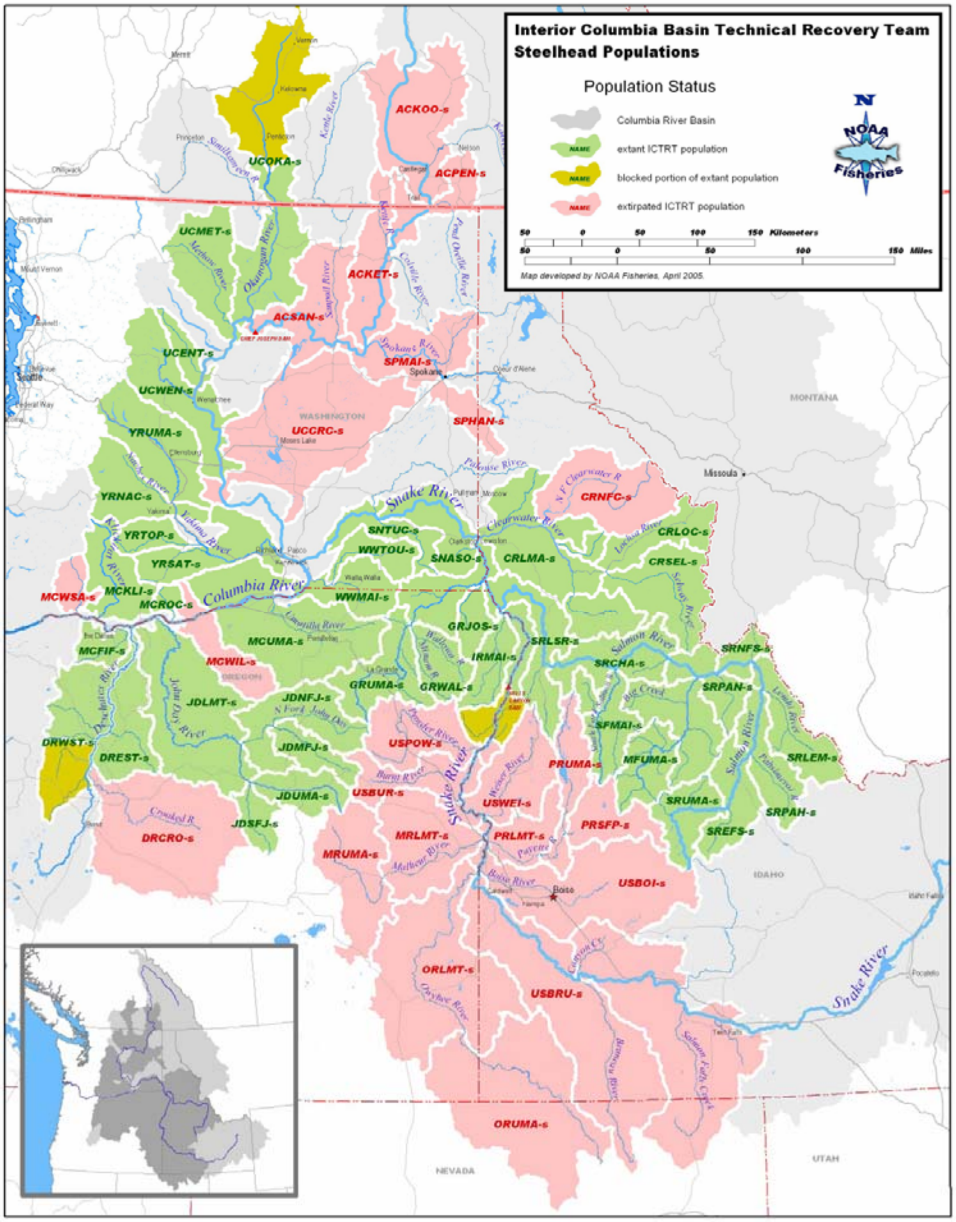

Figure 3-2. Mid-Columbia River Steelhead populations.

Hatchery programs propagate steelhead in three populations and improve kelt (post spawned adult) survival in one population. No artificial programs produce the winter-run life history in the Klickitat River and Fifteenmile Creek populations. All of the ESU hatchery programs are designed to produce fish for harvest, although two are also implemented to augment the naturally spawning populations in the basins where the fish are released.

3.3 Life History

'Steelhead' is the name commonly applied to the anadromous form of the biological species *O. mykiss*. The present distribution of steelhead extends from Kamchatka in Asia, east to Alaska, and down to southern California (NMFS 1999c), although the historic range of *O. mykiss* extended at least to the Mexico border (Busby et al. 1996). *O. mykiss* exhibit perhaps the most complex suite of life history traits of any species of Pacific salmonid. They can be anadromous, or freshwater residents (and under some circumstances, apparently yield offspring of the opposite form). Those that are anadromous can spend up to seven years in fresh water prior to smoltification, and then spend up to three years in salt water prior to first spawning. This species can also spawn more than once (iteroparous), whereas all other species of Oncorhynchus except cutthroat trout (*O. clarki*) spawn once and then die (semelparous). The anadromous form of *O. mykiss* is presently under NMFS jurisdiction, while the resident freshwater forms, usually called "rainbow" or "redband" trout, are under the jurisdiction of the U.S. Fish and Wildlife Service.

Within the range of West Coast steelhead, spawning migrations occur throughout the year, with seasonal peaks of activity. In a given river basin there may be one or more peaks in migration activity; since these "runs" are usually named for the season in which the peak occurs, some rivers may have runs known as winter, spring, summer, or fall steelhead. For example, large rivers, such as the Columbia, Rogue, and Klamath rivers, have migrating adult steelhead at all times of the year. There are local variations in the names used to identify the seasonal runs of steelhead; in Northern California, some biologists have retained the use of the terms spring and fall steelhead to describe what others would call summer steelhead.

Steelhead can be divided into two basic reproductive ecotypes, based on the state of sexual maturity at the time of river entry, and duration of spawning migration (Burgner et al. 1992). The "stream-maturing" type (summer steelhead in the Pacific Northwest and Northern California) enters fresh water in a sexually immature condition between May and October and requires several months to mature and spawn. The "ocean-maturing" type (winter steelhead in the Pacific Northwest and Northern California) enters fresh water between November and April with well-developed gonads and spawns shortly thereafter. In basins with both summer and winter steelhead runs, it appears that the summer run occurs where habitat is not fully utilized by the winter run or a seasonal hydrologic barrier, such as a waterfall, separates them. Summer steelhead usually spawn farther upstream than winter steelhead (Withler 1966, Roelofs 1983, Behnke 1992). Coastal streams are dominated by winter steelhead, whereas inland steelhead of the Columbia River Basin are almost exclusively summer steelhead. Winter steelhead may have been excluded from inland areas of the Columbia River Basin by Celilo Falls or by the considerable migration distance from the ocean. The Sacramento-San Joaquin River Basin may have historically had multiple runs of steelhead that probably included both ocean-maturing and stream-maturing stocks (CDFG 1995, McEwan and Jackson 1996). These steelhead are referred to as winter steelhead by the California Department of Fish and Game (CDFG); however, some biologists call them fall steelhead (Cramer et. al 1995).

Inland steelhead of the Columbia River Basin, especially the Snake River Subbasin, are commonly referred to as either “A-run” or “B-run”. These designations are based on a bimodal migration of adult steelhead at Bonneville Dam (235 km from the mouth of the Columbia River) and differences in age (1 versus 2 years in the ocean) and adult size observed among Snake River steelhead. It is unclear, however, to what degree the life history and body size differences observed upstream are correlated back to the groups forming the bimodal migration observed at Bonneville Dam. A-run steelhead are believed to occur throughout the steelhead-bearing streams of the Snake River Basin and the inland Columbia River. B-run steelhead are thought to be produced only in the Clearwater, Middle Fork Salmon, and South Fork Salmon rivers (IDFG 1994).

Life history characteristics for Mid-Columbia River steelhead are similar to those of other inland steelhead ESUs. Most fish smolt at two years and spend one to two years in salt water before reentering freshwater, where they may remain up to a year before spawning. All steelhead upstream of The Dalles Dam are summer-run fish that enter the Columbia River from June to August. Adult steelhead ascend mainstem rivers and their tributaries throughout the winter, spawning in the late winter and early spring. Fry emergence typically occurs between May and the end of June. A nonanadromous form of *O. mykiss* co-occurs with the anadromous form in this ESU; information suggests that the two forms may not be isolated reproductively.

3.4 Critical Habitat

Critical habitat was designated on February 16, 2000 [65 FR 7764], but vacated by court order on April 30, 2002. On September 2, 2005, NMFS published a final rule (70 FR 52630) to designate critical habitat for Mid-Columbia River steelhead and 12 other ESUs of salmon and steelhead. The final rule takes effect on January 2, 2006. The Critical Habitat Assessment Review Team (CHART) (NMFS 2004c) rated the conservation value of all 5th-field HUCs supporting populations of Mid-Columbia River steelhead.

Essential features of designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water, velocity, space, and safe passage. These features also describe the habitat factors associated with viability for all ESUs. The specific habitat requirements for each ESU differ by life history type and life stage.

Primary constituent elements (PCEs) consist of the physical and biological elements identified as essential to the conservation of the species in the documents identifying critical habitat (Table 3-1). Figure 3-3 depicts those streams designated critical habitat for Mid-Columbia River steelhead.

Table 3-1. Types of sites and essential physical and biological features designated as PCEs, and the life stage each PCE supports.

Site	Essential Physical and Biological Features	ESU Life Stage
Freshwater spawning	Water quality, water quantity, and substrate	Spawning, incubation, and larval development
Freshwater rearing	Water quantity and floodplain connectivity	Juvenile growth and mobility
	Water quality and forage	Juvenile development
	Natural cover[a]	Juvenile mobility and survival
Freshwater migration	Free of artificial obstructions, water quality and quantity, and natural cover[b]	Juvenile and adult mobility and survival
Estuarine areas	Free of obstruction, water quality and quantity, and salinity	Juvenile and adult physiological transitions between salt and freshwater
	Natural cover,[a] forage,[b] and water quantity	Growth and maturation
Nearshore marine areas	Free of obstruction, water quality and quantity, natural cover,[a] and forage[b]	Growth and maturation, survival
Offshore marine areas	Water quality and forage[b]	Growth and maturation

[a] Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

[b] Forage includes aquatic invertebrate and fish species that support growth and maturation.

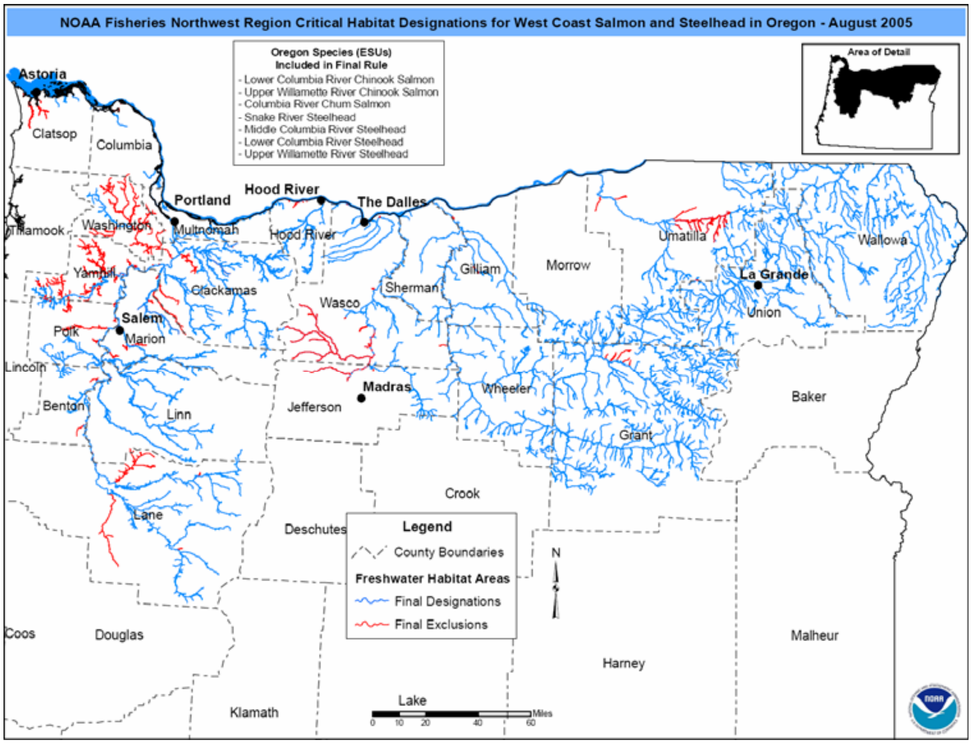

Figure 3-3. Critical habitat designated for salmon and steelhead in Oregon.

Section 4 ESU Structure

This section describes the biological hierarchy for the Mid-Columbia River Steelhead ESU, including major population groupings and independent populations. It also discusses the characteristics that define the Mid-Columbia River steelhead populations in Oregon subbasins.

4.1 Steelhead Population Structure

Steelhead biological structure is hierarchical from the species level to a level below the population. The homing propensity, distribution across the landscape, and the diverse genetic, life history and morphological characteristics that evolve contribute significantly to the hierarchical structure and long-term persistence.

Recovery planning efforts focus on this biologically based hierarchy, which spans ESUs, major groupings, populations and substructure within populations, and reflects the apparent degree of connectivity between the fish in each of these hierarchical levels (Figure 4-1). Two levels in this hierarchy, Evolutionarily Significant Unit (ESU) and population, were formally defined for listing, delisting, and recovery planning purposes. The ICTRT identified an additional level in the hierarchy between the population and ESU levels. These three levels in the hierarchy are described below.

- **Evolutionarily Significant Units:** Two criteria define an ESU of salmon and steelhead listed under the ESA: 1) it must be substantially reproductively isolated from other nonspecific units, and 2) it must represent an important component of the evolutionary legacy of the species (Waples 1991). ESUs may contain multiple populations that are connected by some degree of migration, and hence may have broad geographic areas, transcending political borders.

- **Major Population Groups:** Within ESUs, independent populations can be grouped into larger aggregates that share similar genetic, geographic (hydrographic), and/or habitat characteristics (McClure et al. 2003). These "major groupings" are groups of populations that are isolated from one another over a longer time scale than that defining the individual populations, but which retain some degree of connectivity greater than that between ESUs. The ICTRT defines this level in the hierarchy as Major Populations Groups (MPGs). These MPGs are analogous to “strata” as defined by the Lower Columbia-Upper Willamette TRT and “geographic regions” described by the Puget Sound TRT.

- **Independent Populations:** McElhany et al. (2000) defined an independent population as: *“…a group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season. For our purposes, not interbreeding to a ‘substantial degree’ means that two groups are considered to be independent populations if they are isolated to such an extent that exchanges of individuals among the populations do not* *substantially affect the population dynamics or extinction risk of the independent populations over a 100-year time frame."*

Independent populations are the units that will be combined to form alternative recovery scenarios for MPGs and ESU viability — and, ultimately, the objects of recovery efforts.

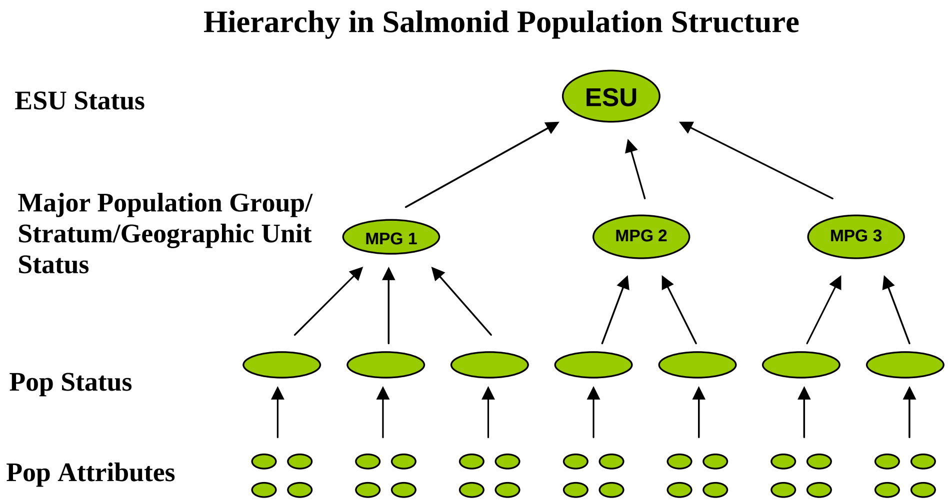

Figure 4-1. Hierarchical levels of ESA-listed, ESU, MPG and independent populations.

4.1.1. Population Structure Adopted for Recovery Planning

The Oregon Department of Fish and Wildlife has adopted the ESU, Major Population Groupings and population structure defined by the ICTRT for purposes of Mid-Columbia River steelhead recovery planning. These groups were defined based on genetic, geographic (hydrographic) and habitat considerations (McClure et al. 2003) with guidance provided by the Viable Salmonid Populations document (McElhany et al. 2000).

Population Identification

As one of its first tasks in recovery planning, the ICTRT delineated independent populations within the listed ESUs in the Interior Columbia Basin, including those in the Mid-Columbia River steelhead ESU. This delineation of population boundaries is critical for effective conservation planning, since incorrect lumping or splitting of populations (or portions of populations) can provide an inaccurate picture of population status. Over- or underestimating the true status (Abundance/Productivity, Spatial Structure/Diversity) may lead to failed recovery efforts. Similarly, if two "true" populations are treated as a single unit, the status of one may mask the other, potentially leading to the loss of one of the populations (McClure et al. 2003).

The ICTRT assessed a variety of information sources to delineate independent populations (McClure et al. 2003). They initially classified "major groups" of populations within ESUs, and then identified independent populations within major groups. They used a variety of data types to define MPGs and independent populations. However, in no case was the entire array of desired information available to inform their decision process. They relied heavily on genetic information, distances between spawning areas related to dispersal (straying distance) as evidence of reproductive isolation, and habitat characteristics. Phenotypic (life history and morphological) characteristics were also considered for distinction at the population level. In addition, they considered two demographic factors. First, because the goal was to identify demographically independent populations, they examined the correlation in abundance time series between areas. Second, they considered historical population size in determining potential population capacity (McClure et al. 2003).

Mid-Columbia River Steelhead ESU Populations

This plan focuses on Oregon steelhead (*Onchorhynchus mykiss*) populations in the Mid-Columbia River steelhead ESU. The ESU includes all natural steelhead populations in streams within the Columbia River basin from above the Wind River in Washington and the Hood River in Oregon (exclusive), upstream to, and including, the Yakima River in Washington, excluding steelhead from the Snake River basin (64 FR 14517; March 25, 1999). Stream systems in the ESU include Rock Creek and the White Salmon, Klickitat, and Yakima rivers on the northern side of the Columbia and Fifteenmile Creek, and the Deschutes, John Day, Umatilla and Walla Walla rivers and Willow Creek on the southern side (Figure 4-2).

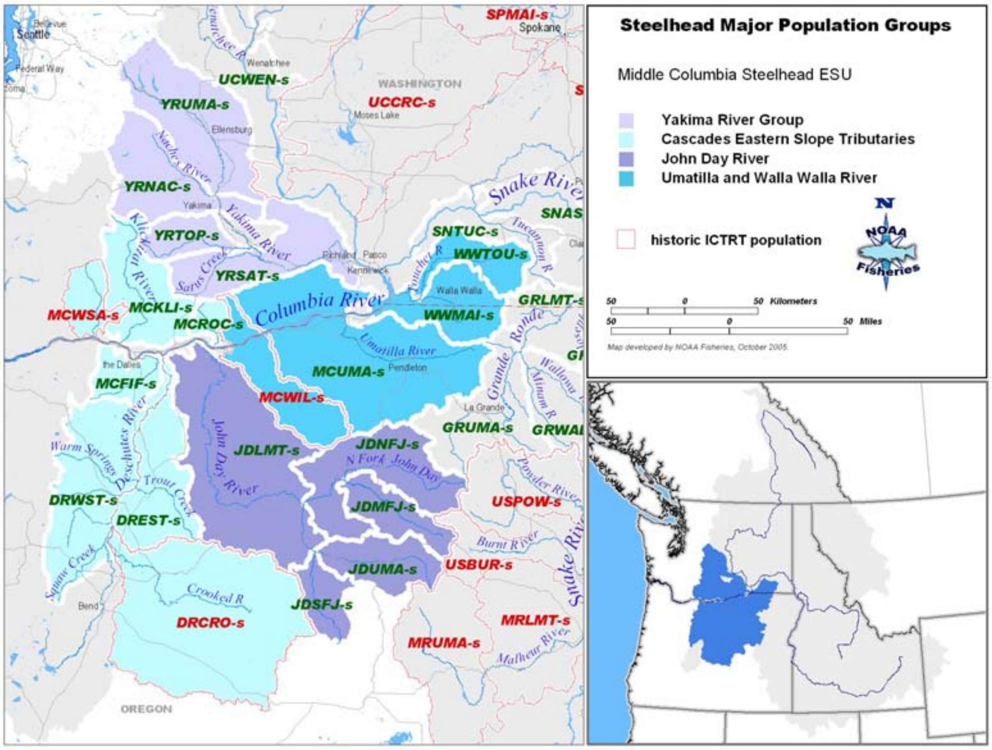

Figure 4-2. Middle Columbia River Steelhead ESU major population groups and populations

The ICTRT has identified four Major Population Groups (MPGs) in the Mid-Columbia River steelhead ESU ─ Cascades Eastern Slope Tributaries, Yakima River, John Day River and Umatilla/Walla Walla Rivers (McClure et al. 2003). Figure 4-3 shows these major population groups. Three of these major population groups contain Mid-Columbia River steelhead from Oregon tributaries.

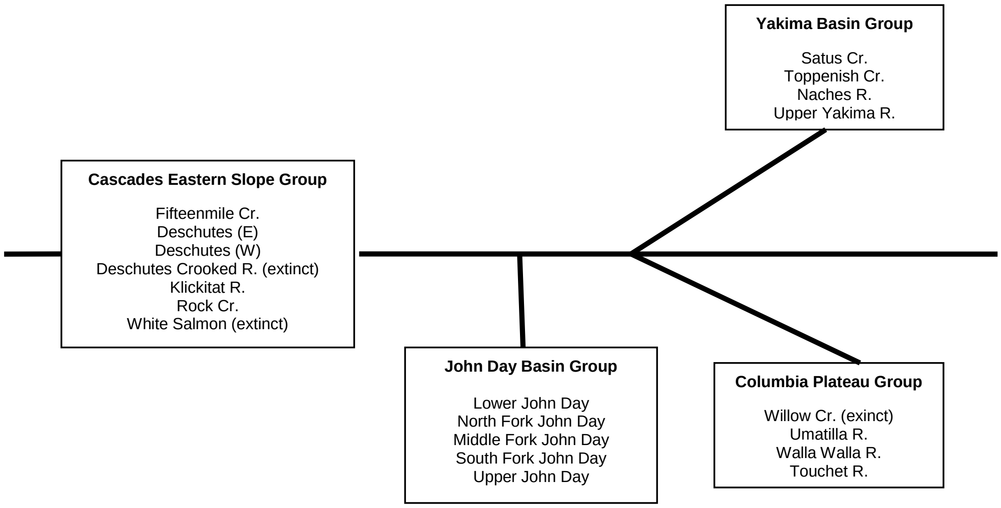

Figure 4-3. Major Population Groupings and populations of Mid-Columbia steelhead.

Together, the four major population groups in the ESU contain seventeen extant and three extinct independent populations (McClure et al. 2003). Subbasins on the Oregon side of the Columbia River historically supported 12 populations in the Mid-Columbia River steelhead ESU. These 12 populations are the subject of this plan and include 10 extant populations: Fifteenmile Creek, Deschutes Westside Tributaries, Deschutes Eastside Tributaries, Lower Mainstem John Day, North Fork John Day, Upper Mainstem John Day, Middle Fork John Day, South Fork John Day, Umatilla River, and Walla Walla River; and two extinct populations: Deschutes/Crooked River and Willow Creek. Five extant populations and one extinct population of Mid-Columbia River steelhead exist on the Washington side of the Columbia River. These six populations are addressed in other recovery plans. Figure 4-4 shows the independent steelhead populations in the ESU.

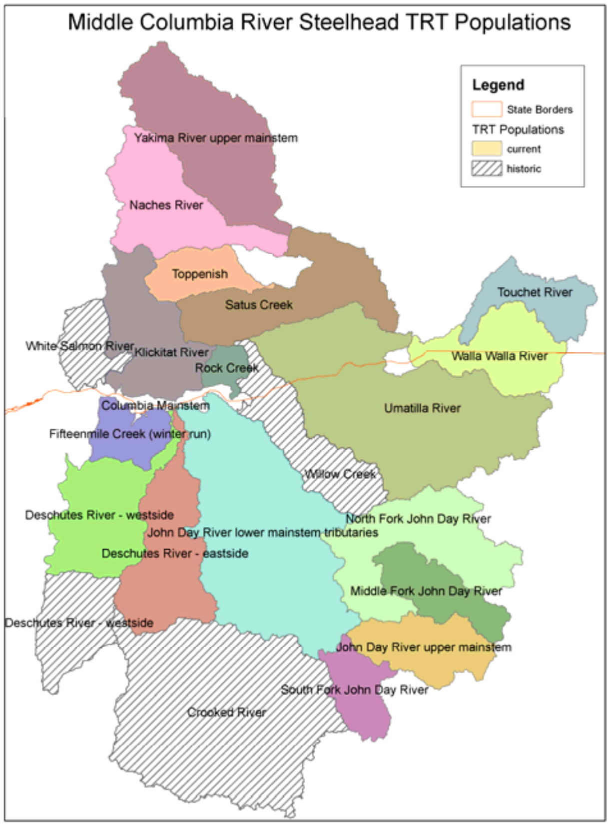

Figure 4-4. Independent populations within the Mid-Columbia River steelhead ESU.

The three major population groups that contain independent Mid-Columbia steelhead populations in Oregon subbasins are described below. These MPGs include the Cascades Eastern Slope Tributaries MPG, John Day River MPG and Walla Walla and Umatilla rivers MPG. Descriptions of the MPGs and independent population groups summarize information provided in the ICTRT report *Independent Populations of Chinook, Steelhead, and Sockeye for Listed Evolutionarily Significant Units within the Interior Columbia River Domain* (McClure et al. 2003) and the update Population Identification Technical Memorandum (McClure et al. 2005). Mid-Columbia River steelhead populations from Washington tributaries are not discussed in this document.

Cascades Eastern Slope Tributaries MPG

The Cascades Eastern Slope Tributaries MPG contains five extant populations and two extinct populations. Oregon subbasins support three of the extant populations ─ Deschutes River Westside Tributaries, Deschutes River Eastside Tributaries, Fifteenmile Creek, and historically supported the extinct Deschutes/Crooked River. Populations in the Cascades Eastern Slope Tributaries MPG are united primarily by geographic proximity. The habitats they occupy are diverse, but the constituent rivers generally drain the eastern slope of the Cascades and the dry Columbia Plateau. The MPG supports summer and winter run life history forms of steelhead.

1. *Fifteenmile Creek:* This population includes Fifteenmile Creek and its tributaries in Eightmile and Ramsey Creeks. It is moderately segregated from other populations (22 km from the Klickitat and 37 km from the nearest spawning in the Deschutes River), and occupies somewhat different habitat. Fifteenmile Creek is the easternmost distribution of winter steelhead in the Columbia basin.

2. *Deschutes River Eastside Tributaries*: The Deschutes River Eastside population encompasses the mainstem Deschutes River from its mouth to the confluence of Trout Creek, and the tributaries entering the Deschutes from the east: Buck Hollow, Bakeoven, and Trout Creeks. Because of uncertainty concerning the relationship of mainstem spawners in the Deschutes Rivers and tributary populations, mainstem reaches were grouped with their respective tributary populations. It was separated from other Cascade eastern slope populations by geographic distance (37 km to Fifteenmile Creek) and run timing (Deschutes steelhead are exclusively summer run fish), and from the Deschutes River Westside tributaries population because of significant habitat and life history differences.

3. *Deschutes River Westside Tributaries:* The Deschutes River Westside tributaries are separated from the eastside tributary population based on habitat and life history characteristics. Included in this population are mainstem spawners from the mouth of Trout Creek upstream to Pelton Dam (current upstream barrier to anadromous fish), and the Warm Springs River and Shitike Creek.

4. *Deschutes Crooked River:* This population is extinct as the area is inaccessible above Pelton Dam. The population boundaries include Crooked River and its tributaries. The population was designated based on historic capacity and distance from other populations. There is a current management agreement and plan to re-establish steelhead production within the Crooked River population boundaries.

John Day River MPG

The ICTRT defined the John Day River MPG as a major grouping based primarily on basin topography and distance from other MPGs. The MPG covers Oregon's John Day River drainage. It is one of the few remaining summer steelhead groups in the Interior Columbia basin that has had no intentional influence from introduced hatchery steelhead and that has recently been classified as strong or healthy (Lee et al. 1997, Huntington et al. 1994). The ICTRT identified five populations in this MPG based on genetic information, demographic correlations, and habitat/ecoregion data. Spawning areas are widely distributed across tributary and mainstem habitats.

1. *Lower John Day River Mainstem Tributaries:* This population includes tributaries to the John Day River downstream of the South Fork John Day River. This widespread population is the most differentiated ecologically from other populations, occupying the lower, drier, Columbia Plateau ecoregion. This habitat divergence was a primary factor in delineating this population. The ICTRT has been asked to review the upper boundary of this population to determine if the boundary should be moved down to the confluence of the North Fork and mainstem. If the ICTRT redefines the population boundaries then the changes will be incorporated into this recovery plan.

2. *North Fork John Day River*: This population was defined based on habitat characteristics, basin topography, and demographic patterns. The North Fork occupies the highest elevation, wettest area in the John Day basin. In addition, it encompasses sufficient habitat to support an independent population. Finally, Chilcote (2001) found that the upper North Fork index count was the most divergent of the John Day stocks indicating demographic independence. The population boundaries include the main stem and tributaries of the North Fork John Day River.

3. *Middle Fork John Day River*: Spawning areas in the Middle Fork John Day River are separated substantially from all other spawning areas, except for those in the North Fork John Day. This distance, combined with habitat differences between this population and the North Fork population, as well as general basin topography led to independent population designation. The population boundaries include the Middle Fork John Day and all its tributaries.

4. *South Fork John Day River*: Genetic data indicate that *O. mykiss* samples from the South Fork John Day River that may include the anadromous form are differentiated from those in other parts of the John Day (Currens et al. 1985). This independent population was defined based on genetic information and basin topography.

5. *Upper Mainstem John Day River*: The upper mainstem John Day River population includes the mainstem John Day River and tributaries upstream from the South Fork. It is separated from the lower main stem based on habitat differences, and from the South Fork because of topography. If the Lower Mainstem population boundary is changed it will move the lower boundary of the Upper Mainstem population downstream to the confluence with the North Fork.

Walla Walla and Umatilla Rivers MPG

The Walla Walla and Umatilla rivers form a major grouping based on shared ecological characteristics and geographic proximity. They both drain the northwestern slopes of the Blue Mountains, with lower reaches in the warmer, drier habitats of the Columbia Plateau. Within this major group, genetic information, distance between spawning aggregates and ecoregional classifications contributed to ICTRT population delineations.

1. *Umatilla River:* The Umatilla River and its tributaries are considered an independent population. Both genetic analysis (Narum and Powell 2002) and distance supports separation of this river from the Walla Walla River.

2. *Walla Walla River*: The Walla Walla River and its tributaries (except the Touchet River) are designated as an independent population. Once major tributary to the Walla Walla River, the Touchet River, was identified as a separate population. Several genetic analyses indicate that *O. mykiss* in the Touchet River are genetically distinct from other *O. mykiss* in the Walla Walla basin (Currens 1985, Currens 1997, Narum et al. in review, Kassler et al. in review). In addition, spawners in the mainstem Walla Walla River and its tributaries are geographically distant (101 km) from those in the Touchet and those in the Umatilla River.

3. *Touchet River:* The ICTRT identified the Touchet River, which flows into the Walla Walla River, as an independent population based on genetic and geographic separation.

4. *Willow Creek:* Willow Creek is an extinct population. It was designated as an independent population based on geographic distance from other populations and capacity sufficient to support an independent population.

Section 5 Desired Status

Section 5 describes the desired status for Oregon's steelhead populations in the Mid-Columbia River steelhead ESU. The section defines two levels of desired status. First, it describes the ICTRT recommendations for viability criteria, which Oregon has adopted for recovery planning purposes. These criteria define viability characteristics for each population, MPGs, and the ESU. It also discusses the biologically based viability criteria used to assess current status and define viability gaps.

Second, the section describes broad sense recovery goals that target population levels well above the levels needed to meet viability, and discusses how viability at the ESU level contributes to these broad-sense recovery goals. This examination is needed because ESA recovery is satisfied by achievement of a recovery threshold and removal of a steelhead ESU from the list of threatened or endangered species, but does not require that other goals, such as those for sustainable fisheries, are attained. These "broad sense" recovery goals are important as they go beyond mere biological viability and provide for sustainable fisheries and other cultural and social benefits.

5.1 Viability Criteria

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5.1.1 Biologically Based Viability Criteria

Under the ESA, a species no longer requires protection when it is no longer in danger of extinction or likely to become endangered within the foreseeable future throughout all or a portion of its range, based on evaluation of the listing factors specified in ESA Section

4(a)(1). To remove the Mid-Columbia River Steelhead ESU from the Federal ESA List, NOAA Fisheries must determine that the ESU, as evaluated under the ESA listing factors, is no longer likely to become endangered. Any new factors identified since listing must also be addressed in this analysis to ensure that the species no longer requires protection as a threatened species.

The ESA requires that recovery plans, to the maximum extent practicable, incorporate objective, measurable criteria which, when met, would result in a determination in accordance with the provisions of the ESA that the species be removed from the Federal List of Endangered and Threatened Wildlife and Plants (50 CFR 17.11 and 17.12). The recovery criteria comprise the core standards that NOAA Fisheries believes will lead to conditions upon which the decision to de-list a species will be based. The ESA's listing factors, and not the Recovery Plan, are the legal basis for making de-listing decisions.

One of the main tasks assigned to the NOAA Fisheries Technical Recovery Teams for recovery planning was to recommend biologically based viability criteria for application to ESUs of salmon and steelhead listed under the ESA. Viability criteria identify characteristics and conditions that, when met, would describe viable populations and a viable ESU. Viability criteria identify the metrics and thresholds that will be used to determine the status of a population and the viability risk.

The NOAA Technical Memorandum *Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units (*McElhany et al. 2000) provides general guidance for setting viability objectives at the ESU and component population levels. The viability guidelines provided by McElhany et al. (2000) address four major considerations: abundance, productivity, spatial structure and diversity. ESU-level viability criteria consider the appropriate distribution and characteristics of component populations to maintain a viable ESU in the face of longer-term ecological and evolutionary processes. The general approach identified for viability criteria has five essential elements:

Stratified Approach: Life history and ecological complexity that historically existed should have a high probability of persistence. The ICTRT stratified the Mid-Columbia River steelhead ESU into groups based on ecoregion characteristics (Eastern Cascades, Columbia plateau, John Day and Yakima), life history types (summer, winter, and summer/winter) and other geographic and genetic considerations.

Viable Populations: Some individual populations within a MPG should have persistence probabilities consistent with a high probability of MPG persistence. The ICTRT defined high persistence probability based on the presence of at least two or one-half of historic populations whichever is greater with a negligible risk of extinction.

***Representative Populations*:** Representative populations need to achieve viability criteria or be maintained but not every historical population needs to meet viability criteria. Viable combinations of populations should include "core" populations that are highly productive, "legacy" populations that represent historical genetic diversity, and dispersed populations that minimize susceptibility to catastrophic events.

Non-deterioration: No population should be allowed to deteriorate until ESU recovery is assured, and all extant populations must be maintained. Current populations and population segments must be preserved. Recovery measures will be needed in most areas to arrest declining status and offset the effects of future impacts.

Safety Factors: Higher levels of recovery should be attempted in more populations than the minimum needed to achieve ESU viability because not all attempts will be successful. Recovery efforts must target more than the minimum number of populations and more than the minimum population levels thought to ensure viability. Some populations should be highly viable.

During recovery planning, viability objectives are being recommended at the ESU, MPG, and component population levels as defined by the ICTRT (McClure et al. 2003). Assessments of viability at these different levels follow guidelines and approaches recommended by the ICTRT. The ICTRT's ESU-level viability criteria are designed to assess risk for Abundance/Productivity and Spatial Structure/Diversity at the population level. Assessments are then rolled-up to the MPG and ESU levels.

Independent Population-level Viability Criteria

Guidelines for population-level viability (McElhany et al. 2000) state that a viable population should be large enough to:

1. have high probability of surviving environmental variation observed in the past and expected in the future,
2. be resilient to environmental and anthropogenic disturbances,
3. maintain genetic diversity, and
4. support/provide ecosystem functions.

To address these guidelines, the ICTRT grouped specific population level criteria into two categories: measures addressing abundance and productivity, and measures addressing spatial structure/diversity considerations. They also developed a framework for compiling an aggregate risk score for a population based on the results of applying the individual criteria.

Population Abundance and Productivity

These two population performance characteristics are linked to drive extinction risk. Abundance refers to the average number of spawners in a population over a generation or more. Productivity, or population growth rate, refers to the performance of the population over time in terms of recruits produced per spawner.

Viable populations should demonstrate sufficient productivity to support a net replacement rate of 1:1 or higher at abundance levels established as long-term targets. Productivity rates at relatively low numbers of spawners should, on average, be sufficiently greater that 1.0 to allow the population to rapidly return to abundance target levels. Following guidelines from McElhany et al. (2000), the ICTRT identified the following objective for population abundance and productivity:

> *Abundance should be high enough that 1) in combination with intrinsic productivity, declines to critically low levels would be unlikely assuming recent historical patterns of environmental variability; 2)compensatory processes provide resilience to the effects of short term perturbations; and, 3) subpopulation structure is maintained (e.g., multiple spawning tributaries, spawning patches, life history patterns).*

The ICTRT used the Viability Curve concept (e.g., LC/WTRT 2003) as a framework for defining population specific abundance and productivity criteria to meet this objective. A viability curve describes those combinations of abundance and productivity that yield a particular risk threshold. The two parameters are linked relative to extinction risks associated with short-term environmental variability. This approach recognizes that relatively large populations are more resilient in the face of year-to-year variability in overall survival rates than smaller populations. Populations with relatively high intrinsic productivity ─ the expected ratio of spawners to their parent spawners at low levels of abundance ─ are also more robust at a given level of abundance than populations with lower intrinsic productivity. Combinations of abundance and productivity are characterized by viability curves that represent specific extinction risks. Table 5-1 shows combinations of abundance and productivity that represent the 5% extinction risk viability curves for Mid-Columbia River steelhead (Cooney et al. 2005).

Table 5-1. Mid-Columbia River steelhead population viability curves in tabular format (return per spawner and population growth rate versions)[a]. (Cooney et al. 2005).

Mid-Columbia Steelhead	Spawner to Spawner Measure Minimum Abundance by Population Size Categories					Population Growth Rate (Lambda) Measure Minimum Abundance by Population Size Categories			
Growth Rate	*Basic*	*Intermediate*	*Large*	*Very large*	*Growth Rate*	*Basic*	*Intermediate*	*Large*	*Very Large*
1.05	12,515	12,515	12,515	12,515	1.02	76,528	76,528	76,528	76,528
1.075	9,391	9,391	9,391	9,391	1.04	25,094	25,094	25,094	25,094
1.1	6,268	6,268	6,268	6,268	1.06	10,764	10,764	10,764	10,764
1.125	5,000	5,000	5,000	5,000	1.08	4,686	4,686	4,686	4,686
1.13	4,600	4,600	4,600	4,600	1.1	3,026	3,026	3,026	3,026
1.15	4,203	4,203	4,203	4,203	1.115	2,000	2,000	2,000	2,250
1.175	3,565	3,565	3,565	3,565	1.12	1,829	1,829	1,829	2,250
1.2	2,818	2,818	2,818	2,818	1.14	1,341	1,341	1,500	2,250
1.25	2,041	2,041	2,041	2,250	1.15	1,000	1,000	1,500	2,250
1.3	1,581	1,581	1,581	2,250	1.16	975	975	1,500	2,250
1.35	1,269	1,269	1,500	2,250	1.18	829	829	1,500	2,250
1.4	957	1,000	1,500	2,250	1.2	682	750	1,500	2,250
1.45	800	1,000	1,500	2,250	1.22	560	750	1,500	2,250
1.5	682	1,000	1,500	2,250	1.23	500	750	1,500	2,250
1.55	605	1,000	1,500	2,250	1.24	500	750	1,500	2,250
1.6	540	1,000	1,500	2,250	1.26	500	750	1,500	2,250
1.65	500	1,000	1,500	2,250	1.28	500	750	1,500	2,250
1.7	500	1,000	1,500	2,250	1.3	500	750	1,500	2,250

[a] Combinations of abundance and productivity exceeding these combinations would have a projected extinction risk of less than 5% in 100 years, assuming continuation of recent (1978-present) variation in return rates. Spawner to spawner based estimates generated using Hockey-Stick recruitment function and average variance (0.23), autocorrelation (0.69) and age structure (0.22 age 3/.46 age 4/.28 age 5/0.04 age 6) for populations in the ESU. Population growth rate based estimates generated using average running sums based variance (0.17) for ESU populations.

The ICTRT developed viability curves representing 1%, 5%, and 25% extinction risk. Populations were grouped into four size categories based on historic capacity, represented by the weighted intrinsic potential area within the population boundaries. In order to determine quantity and quality of salmon and steelhead habitat within defined populations, the ICTRT developed a model for calculating intrinsic spawning habitat potential. This metric enabled the ICTRT to quantify and qualify potential habitat based on the relationship of spawning habitat use and local geo-physical features. A Geographic Information System (GIS) was used for the compilation of ecological data, and model development and output. Datasets describing spawning distribution and instream habitat characteristics were key in developing the relationship. After spatial data acquisition, model parameters were established by comparing mapped salmon and steelhead distribution to stream physiography.

In general, spawning surveys were utilized to describe a species spatial structure by locality and density. Mapped distributions were then evaluated against stream attributes calculated from common spatial data themes. These included Digital Elevation Models (DEM), the National Hydrography Dataset (NHD), and climatic data from the National Climatic Data Center (NCDC). The NHD layer was subdivided into a continuous series of 200 meter reaches, and this became our basic analysis unit. Using information derived from our GIS layers, the ICTRT was able to compute stream gradient, wetted and bankfull width, and channel confinement, and then assign this information to each 200 meter segment within the stream network. These attributes were concatenated into groupings representing all observed combinations, which included 4 width classes, 6 gradient classes, and 3 confinement classes. Each discrete category was assessed by using statistical methods to compare the relative density of spawners observed within each group. Each habitat class was then assigned a rating of "high", "moderate", "low", or "none" in regards to spawning habitat potential (Table 5-2).

From this analysis, the ICTRT generated similar categories for all stream segments within the Interior Columbia ESUs and assigned their corresponding habitat ratings. By using reach length and width values they computed habitat area for all streams and weighted this value by intrinsic spawning potential, so that "good" = (area * 1.0), "moderate" = (area * 0.5), "low" = (area * 0.25), and "none" = (area * 0.0). The ICTRT identified areas above natural barriers and assigned these reaches a rating of "none." Natural barriers were identified through expert opinion from field biologists and gradient breaks computed from the DEM. Once calculated, the weighted stream area was summarized for each population and size categories were generated based on these values.

Additionally, they analyzed how weighted habitat was aggregated within populations and labeled reaches with continuous high and moderate ratings as spawning branches. A spawning branch was defined as a stream reach with enough habitat to support 50 spawners. The accumulation of branches within populations then became the basis for defining Major Spawning Areas (MaSA). A process was developed for aggregating MaSAs by evaluating the continuity of branch habitat and the spatial composition of stream junctions. A MaSA was required to have enough weighted habitat to support 500 spawners. MaSAs are an important habitat unit for assessing ecological complexity within populations, and for the spatial structure/diversity viability assessment.

Table 5-2. Habitat classes showing spawning potential by steelhead and chinook.

Habitat Factors			Relative Rating	
Stream Width	**Gradient**	**Valley Width**	**Steelhead**	**Chinook**
<3.7 m (chin) WETTED <3.8 m (sthd) BANKFULL	***all gradient classes***		**None**	**None**
ABOVE to 25 m	***0 to .5***	*20x > BF > 4x*	**Low**	**High**
		> 20x BF	**Low**	**High**
		confined (<= 4x BF)	**Low**	**Medium**
	.5 to 1.5	*20x > BF > 4x*	**Medium**	**Medium**
		> 20x BF	**Medium**	**High**
		confined (<= 4x BF)	**Medium**	**Low**
	1.5 to 4.0	*20x > BF > 4x*	**High**	**Low**
		> 20x BF	**High**	**Medium**
		confined (<= 4x BF)	**High**	**Low**
	4.0 to 7.0	*>4x BF*	**High**	**Low**
		confined (<= 4x BF)	**High**	**None**
	7.0 to 15.0	*>4x BF*	**Low**	**None**
		confined (<= 4x BF)	**Low**	**None**
	>15.0	*>4x BF*	**None**	**None**
		confined (<= 4x BF)	**None**	**None**
25 to 50	***0 to 0.5***	*>4x BF*	**Low**	**Medium**
		confined (<= 4x BF)	**Low**	**None**
	.5 to 4.0	*>4x BF*	**Medium**	**Low**
		confined (<= 4x BF)	**Medium**	**Low**
	4.0 to 10.0	*>4x BF*	**Low**	**Low**
		confined (<= 4x BF)	**Low**	**Low**
	10.0 to 15.0	*>4x BF*	**Low**	**None**
		confined (<= 4x BF)	**Low**	**None**
	> 15.0	*>4x BF*	**None**	**None**
		confined (<= 4x BF)	**None**	**None**
greater than 50 m wetted	***all gradient classes***	*>4x BF*	**Low**	**Low**
		confined (<= 4x BF)	**None**	**None**

The ICTRT determined that abundance levels below 500 individuals for any population would pose unacceptable risk for inbreeding depression and other genetic concerns (McClure et al. 2003), and established a minimum abundance threshold of 500 individuals for the basic size populations. Higher spawning threshold sizes were established incrementally for the three larger population sizes. Viability curves for all four size categories were truncated at the minimum abundance threshold level. Table 5-1 shows the combination of abundance and productivity values for all four size categories that yield a 5% risk of extinction. Populations were also categorized by their historic spatial distribution pattern and complexity. Table 5-3 presents population characteristics, spatial complexity designation, minimum abundance thresholds, and minimum productivity at threshold escapement needed to achieve a 95% probability of persistence over 100 years.

Table 5-3. Population characteristics and minimum abundance and productivity(at the threshold abundance level) values that represent levels needed to achieve a 95% probability of persistence over 100 years for Mid-Columbia steelhead populations in Oregon.

Population	Extant/ Extinct	Life History	Size	Spatial Category	Threshold Abundance	Minimum Productivity
Cascades Eastern Slope Tributaries MPG						
Fifteenmile Creek	Extant	Winter	Intermediate	C-Trellis	1,000	1.4
Deschutes River Eastside	Extant	Summer	Intermediate	B-Dendritic	1,000	1.4
Deschutes River Westside	Extant	Summer	Large	B-Dendritic	1,500	1.35
Deschutes Crooked River	Extinct	Summer	Very Large	B-Dendritic	2,250	1.25
John Day River MPG						
Lower Mainstem John Day River	Extant	Summer	Very Large	B-Dendritic	2,250	1.25
North Fork John Day River	Extant	Summer	Large	B-Dendritic	1,500	1.35
Middle Fork John Day River	Extant	Summer	Intermediate	B-Dendritic	1,000	1.4
South Fork John Day River	Extant	Summer	Basic	B-Dendritic	500	1.65
Upper Mainstem John Day River	Extant	Summer	Intermediate	B-Dendritic	1,000	1.4
Umatilla/Walla Walla Rivers MPG						
Willow Creek	Extinct	Summer	Intermediate	B-Dendritic	1,000	1.4
Umatilla River	Extant	Summer	Large	B-Dendritic	1,500	1.35
Walla Walla River	Extant	Summer	Intermediate	B-Dendritic	1,000	1.4

The ICTRT also developed specific guidance for assessing current status relative to the Abundance/Productivity viability risk curves (Cooney et al. in preparation). Using this guidance, we calculated mean abundance and standard error as the most recent 10-year geometric mean of natural origin spawners. We calculated productivity as recruits per spawner (spawner to spawner) from the 20 most recent completed brood years (less if only that is available). Only natural origin fish were counted as recruits, and both natural origin and hatchery origin fish spawning naturally were counted as parents. We determined low abundance/productivity by limiting the data series to only include the lowest parent population sizes. We determined the mediam parent abundance level, and used the values equal to or less than the median. In most cases, this resulted in ten recruits-per-spawner data points. To further increase the accuracy and precision of the productivity estimate, we adjust the recruits-per-spawner for smolt-to-adult return rates (SAR), thus reducing the variation resulting from variable smolt outmigration and marine survival. We calculated a geometric mean and standard error from the censused, SAR adjusted recruits per spawner dataset. For the Deschutes River Eastside population, we used stock-recruitment curve fitting procedures to estimate the intrinsic productivity because there were too few low parent abundance recruits-per-spawner observations. We used an aggregate SAR developed from Deschutes, Umatilla, Snake, and Columbia rivers SAR data sets. Three approaches were presented by the ICTRT for considering uncertainty in the risk rating. We choose the following for use in our assessments. Standard errors were adjusted upward by a multiplicative factor to establish an adjusted lower standard error bounds to compare against the viability curves. When the adjusted lower end of the error term for productivity resides above the 25% risk curve, there is a 95% probability that the true value is above the 25% risk level. To be considered low risk, the point estimate must reside above the 5% risk level for abundance and productivity and the adjusted lower standard error bound for productivity must reside above the 25% risk level. To be considered very low risk the point estimate for abundance and productivity must reside above the 1% risk level and there must be less the 1 in 100 chance that the true productivity value is below the 25% risk level. If the point estimate for abundance and productivity falls between the 5% and 25% risk level, then the population is considered at moderate risk regardless of where the adjusted standard error bounds reside, which equates to a minimum of 50% probability that the true value is above the 25% risk level. If the ICTRT provides an alternative method for interpretation we will update the abundance/productivity assessments. Figure 5-1 provides an example of an Abundance/Productivity viability curve.

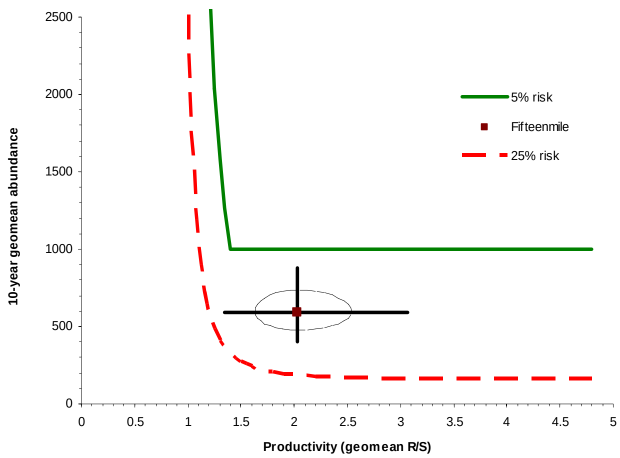


Figure 5-1. Example of Abundance/Productivity viability curves including Fifteenmile Creek current abundance productivity point estimate with standard error elipse and adjusted standard error bounds

Spatial Structure and Diversity

Spatial structure and diversity considerations are combined in the evaluation because they are closely integrated. Spatial structure concerns a population's geographic distribution and the processes that affect that distribution. Diversity refers to the distribution of genetic, life history and phenotypic variation within and among populations.

Distribution influences a population's viability because populations with restricted distribution and few spawning areas are at a higher risk of extinction due to catastrophic environmental events than are populations with more widespread and complex spatial structures. A population with a complex spatial structure, including multiple spawning areas, may experience more opportunity for gene flow, developmental substructure, and life history diversity.

Population-level diversity is similarly important for long-term persistence. Populations exhibiting greater diversity are generally more resilient to short-term and long-term environmental changes. Phenotypic and life history diversity allow populations to use a wider array of environments, and protect populations against short-term temporal and spatial environmental changes. Underlying diversity provides the ability to survive long-term environmental changes.

McElhany et al. (2000) provide a number of guidelines for the spatial structure and diversity of viable salmonid populations that consider these principles (Figure 5-2).

Spatial Structure

1. Habitat patches should not be destroyed faster than they are naturally created.
2. Natural rates of straying among subpopulations should not be substantially increased or decreased by human actions.
3. Some habitat patches should be maintained that appear to be suitable or marginally suitable, but currently contain no fish.
4. Source subpopulations should be maintained.
5. Analyses of population spatial processes should take uncertainty into account.

Diversity

1. Human-caused factors such as habitat changes, harvest pressures, artificial propagation, and exotic species introduction should not substantially alter variation in traits such as run timing, age structure, size, fecundity, morphology, behavior, and molecular genetic characteristics.
2. Natural processes of dispersal should be maintained. Human-caused factors should not substantially alter the rate of gene flow among populations.
3. Natural processes that cause ecological variation should be maintained.
4. Population status evaluations should take uncertainty about requisite levels of diversity into account.

Figure 5-2. Viable salmonid population spatial structure and diversity guidelines (McElhany et al. 2000).

The ICTRT identified two primary goals that spatial structure and diversity criteria should address: 1) maintaining natural rates and levels of spatially mediated processes, and 2) maintaining natural patterns of variation. They also provided a format outlining guidelines for achieving these goals. The format identifies mechanisms, factors and metrics appropriate for assessing population status. Table 5-3 summarizes the associations between these goals, mechanisms, factors and metrics. Some viability metrics include variable criteria that are dependent on the spatial complexity designation of the population. Spatial complexity designations are presented in Table 5-3.

Table 5-4. Organization of goals, mechanisms, factors and metrics for spatial structure and diversity risk rating.

Goal	Mechanism	Factor	Metrics
A. Allowing natural rates and levels of spatially-mediated processes.	1. Maintain natural distribution of spawning aggregates.	a. number and spatial arrangement of spawning areas.	Number of MSAs, distribution of MSAs, and quantity of habitat outside MSAs.
		b. Spatial extent or range of population	Proportion of historical range occupied and presence/absence of spawners in MSAs
		c. Increase or decrease gaps or continuities between spawning aggregates.	Change in occupancy of MSAs that affects connectivity within the population.
B. Maintaining natural levels of variation.	1. Maintain natural patterns of phenotypic and genotypic expression.	a. Major life history strategies.	Distribution of major life history expression within a population
		b. Phenotypic variation.	Reduction in variability of traits, shift in mean value of trait, loss of traits.
		c. Genetic variation.	Analysis addressing within and between population genetic variation.
	2. Maintain natural patterns of gene flow.	a. Spawner composition.	(1) Proportion of hatchery origin natural spawners derived from a local (within population) brood stock program using best practices.
			(2) Proportion of hatchery origin natural spawners derived from a within MPG brood stock program, or within population (not best practices) program.
			(3) Proportion of natural spawners that are unnatural out-of MPG strays.
			(4) Proportion of natural spawners that are unnatural out-of ESU strays.
	3. Maintain occupancy in a natural variety of available habitat types.	a. Distribution of population across habitat types.	Change in occupancy across ecoregion types

Integrating the Four VSP Parameters

These abundance/productivity and spatial structure/diversity considerations form the centerpiece of the ICTRT's framework for assessing ESU viability (Cooney et al. 2005). The approach is based on guidelines in McElhany et al. (2000), the results of previous applications (i.e., Puget Sound and Lower Columbia/Willamette TRTs and Upper Columbia Qualitative Analysis Review), and a review of specific information available relative to listed Interior Columbia ESU populations.

The ICTRT integrates all four VSP parameters using a simple matrix approach (Table 5-5). The abundance/productivity risk level combines the abundance and productivity VSP criteria using a viability curve. The spatial structure/diversity risk level integrates across 12 measures of spatial structure and diversity. The overall diversity viability rating that any population is assigned is determined using two guiding principles. First, the VSP concept (McElhany et al. 2001) provides a 5% risk criterion to define a viable population. Therefore, any population scored moderate or high risk in the abundance/productivity criteria would not meet the recommended viable standards. In addition, any population that is high risk in SS/D would not be considered viable. Second, populations with a Very Low rating for A/P and at least a Low rating for SS/D are considered to be "Highly Viable." Populations with a Low rating for A/P and a Moderate rating for SS/D are considered "Minimally Viable." This integration approach places greater emphasis on the abundance/productivity criteria. These individual ratings are then integrated to determine the viability of major population groups within an ESU. The assessments of individual MPGs are aggregated to assess the ESU as a whole (ICTRT 2005).

Table 5-5. Matrix of possible Abundance/Productivity and Spatial Structure/Diversity scores for application at the population level. Percentages for abundance and productivity (A/P) scores represent the probability of extinction in a 100-year time period. Cells that contain a "V" are considered viable combinations; "HV" indicates Highly Viable combinations and "MV" indicates Minimally Viable combinations. Cells that are not labeled "HV," "V," or "MV" are a risk level below what the ICTRT recommends as viable. (Cooney et al. 2005).

Abundance/Productivity Risk	Spatial Structure/Diversity Risk:	Very Low	Low	Moderate	High
	Very Low (<1%)	HV	HV	V	
	Low (<5%)	V	V	MV	
	Moderate (6-25%)				
	High >(25%)				

Major Population Group Viability Criteria

The ICTRT recommended Major Population Group (MPG) level risk criteria that assess the level of risk associated with its component populations. While individual populations meeting viability criteria are expected to have low risk of extinction, these additional, MPG-level criteria ensure robust functioning of the population group and provide resilience to catastrophic loss of one or more populations. In developing these criteria, the ICTRT assumed that catastrophes do not increase dramatically in frequency, that populations are not lost permanently (due to catastrophe or anthropogenic impacts) and that permanent reductions in productivity, including long-term, gradual reductions in productivity do not occur (Cooney et al. 2005).

MPG Viability Criteria (from Cooney et al. 2005)

The following six criteria must be met for an MPG to be regarded as at low risk (viable):

1. One-half of the populations historically within the MPG (with a minimum of two populations) must meet at least minimum viability standards.
2. At least one population must be categorized as being "Highly Viable".
3. Viable populations within an MPG must include some populations classified (based on historical intrinsic potential) as "Very Large," or "Large," and "Intermediate" in the same proportion as were present within the MPG historically.
4. Populations not meeting viability standards should be maintained with sufficient productivity that the overall MPG productivity does not fall below replacement (i.e. these areas should not serve as significant population sinks).
5. Where possible, given other MPG viability requirements, some populations meeting viability standards should be contiguous AND some populations meeting viability standards should be disjunct from each other.
6. All major life history strategies (e.g. spring and summer run timing) that were present historically within the MPG must be represented in populations meeting at least the minimum viability requirements.

MPG Recovery Scenarios Options

Cascades Eastern Slope Tributaries Major Population Grouping

This MPG contains seven populations, including the four Oregon populations described in Table 5-6.

Table 5-6. Characteristics of Steelhead Populations in the Cascades Eastern Slope Tributaries MPG

Population	Extant/Extinct	Life History	Size Category
Fifteenmile Creek	Extant	Winter Run	Intermediate
Deschutes River Eastside	Extant	Summer Run	Intermediate
Deschutes River Westside	Extant	Summer Run	Large
Deschutes Crooked River	Extinct	Summer Run	Very Large
Klickitat River	Extant	Winter/Summer Run	Large
White Salmon	Extinct	Summer Run	Intermediate
Rock Creek	Extant	Summer Run	Basic

The following ICTRT criteria are recommended for this MPG to be regarded as viable:

1. One half of the historic populations in the MPG must meet at least minimum viability standards. This equates to four for this MPG.

2. Viable populations within the MPG must include proportional representation of the Large and Intermediate sizes. Thus, two large populations and two intermediate populations must be included.

3. All major life history strategies present historically must be represented. So at least one summer run, one winter run, and one population with winter/summer combination must be included.

4. One population must be highly viable.

5. All populations that do not meet viable status have to be maintained

Given the above criteria, a viability scenario for this MPG must include the following populations:

- Fifteenmile Creek—represents a winter run and intermediate size requirement.
- Deschutes River Eastside—represents a summer run and intermediate size requirement.
- Deschutes River Westside—represents a summer run and large size requirement.
- Klickitat River—represents a winter/summer run and a large size requirement.
- Rock Creek—must be maintained

John Day River Major Population Grouping

There are a total of five populations in this MPG. heir characteristics are described in Table 5-7.

Table 5-7. Characteristics of Steelhead Populations in the John Day River MPG.

Population	Extant/Extinct	Life History	Size Category
Lower Mainstem John Day	Extant	Summer Run	Very Large
North Fork John Day	Extant	Summer Run	Large
Middle Fork John Day	Extant	Summer Run	Intermediate
South Fork John Day	Extant	Summer Run	Basic
Upper Mainstem John Day	Extant	Summer Run	Intermediate

The following ICTRT criteria are recommended for this MPG to be regarded as viable:

1. One half of the historic populations in the MPG must meet at least minimum viability standards. This equates to three for this MPG.

2. Viable populations within the MPG must include proportional representation of the Very Large/Large and Intermediate sizes. Thus, two very large/large and one intermediate sized populations must be included.

3. All major life history strategies present historically must be represented. There are only summer-run life histories.

4. One population must be highly viable.

5. All populations that do not meet viable status must be maintained

Given the above criteria, a viability scenario for this MPG must include the following populations:

- Lower Mainstem John Day—this population is required to meet the very large requirement because it is the only very large size population.

- North Fork John Day—this population would be chosen because its current status is highly viable and it would meet one of the large size requirements.

- Middle Fork John Day or Upper Mainstem John Day—either one of these populations could meet the second intermediate size population requirement. Both populations will be managed to achieve viable status.

- South Fork population must be maintained.

- South Fork—must be maintained

Umatilla/Walla Walla Rivers Major Population Grouping

This MPG includes four populations, including the three Oregon populations described in Table 5-8.

Table 5-8. Characteristics of Steelhead Populations in the Umatilla/Walla Walla Rivers MPG

Population	Extant/Extinct	Life History	Size Category
Willow Creek	Extinct	Summer Run	Intermediate
Umatilla River	Extant	Summer Run	Large
Walla Walla River	Extant	Summer Run	Intermediate
Touchet River	Extant	Summer Run	Intermediate

The following ICTRT criteria are recommended for this MPG to be regarded as viable:

1. One half of the historic populations in the MPG must meet at least minimum viability standards. This equates to two for this MPG.

2. Viable populations within the MPG must include proportional representation of the Large and Intermediate sizes. Thus, one of each must be included.

3. All major life history strategies present historically must be represented. There are only summer-run life histories.

4. One population must be highly viable.

5. All populations that do not meet viable status must be maintained.

Given the above criteria, the following two viability scenarios are options:

- Umatilla River—this population is required to meet the large requirement because it is the only large size population.

- Walla Walla River or Touchet River—either one of these populations could meet the second population requirement at intermediate size. The viability scenario for this MPG should include managing the Walla Walla and Touchet rivers for viable status.

ESU Viability Criteria

The ICTRT determined that, because MPGs are geographically and genetically cohesive groups of populations, they are critical components of ESU-level spatial structure and diversity. Having all MPGs within an ESU at low risk provides the greatest probability of persistence of any ESU. The box below shows ESU-level viability criteria defined by the ICTRT.

ESU Viability Criteria (from Cooney et al. 2005)

1. All extant MPGs and any extirpated MPGs critical for proper functioning of the ESU must be at low risk.
2. ESUs that contained only one MPG historically or that include only one MPG critical for proper function must meet the following criteria:
   a. The single MPG must meet all the requirements to be at low risk (see above). In addition:
   b. Two-thirds or more of the populations within the MPG historically must meet minimum viability standards; AND
   c. At least two populations must meet the criteria to be "Highly Viable."

These extirpated areas will be evaluated to determine whether extirpated MPGs are critical for proper functioning of the ESU using the following considerations:

- Likely demographic (abundance and productivity) contribution of the MPG and its component populations to the ESU.
- Spatial role of the MPG in the ESU (e.g. does the extirpated MPG create a gap in the distribution of the ESU?)
- Likely contribution to overall ESU diversity (e.g. does the extirpated MPG occupy habitats that are substantially different from other habitats currently occupied in the ESU?)

5.2 Broad Sense Recovery Goals

During the recovery planning effort, the Oregon Middle Columbia Steelhead Sounding Board led the development of broad sense recovery goals for the region. The Sounding Board included citizens from all Oregon subbasins within the Mid-Columbia steelhead ESU. During the process, the board members worked with recovery planners to identify goals that would provide abundance, productivity, and diversity well above basic viable levels to allow for sustainable fisheries and other cultural uses.

In the draft recovery plan, this section will describe the broad sense recovery goals for Mid-Columbia River steelhead populations. While ESA recovery is satisfied by achievement of a viability criteria and removal of the steelhead ESU from the list of threatened or endangered species, it is desired that recovery goals evolve into broad sense recovery that goes beyond viability and provides for the historic natural-cultural values that were associated with healthy salmonid populations. At this time, the Sounding Board has not completed development of the broad sense recovery goals. What is presented in the next several pages is background information from subbasin plans that the Sounding Board is considering in its deliberations.

5.2.1. Range of Existing Broad Sense Recovery Goals from Subbasin Plans

In each subbasin, citizens have looked beyond mere viability and adopted goals and objectives that identify desired levels of salmonid production and habitat restoration needed to meet other legal requirements and social needs. These goals and objectives envision salmon and steelhead populations that are not only viable, but that are also harvestable and promote overall watershed health.

Most recently, during the Northwest Power and Conservation Council's subbasin planning process, many residents of Oregon watersheds within the Mid-Columbia River steelhead ESU recognized the strong linkage between healthy, ecosystem functions and viable, productive fish and wildlife populations. As members of coordinating groups and councils overseeing the development of subbasin management plans, they envisioned future watersheds that were "healthy", "self-sustaining" and "productive". These visions framed the development of the biological objectives and thereby the strategies identified in the management plans to change conditions within the subbasins. Consequently, visions to strengthening these ecosystem processes, functions and dynamics formed the core of their management direction.

In many of these subbasin plans and in other fisheries management plans, goals and objectives call for steelhead populations that are productive enough to provide for harvest. Increased opportunity for harvest occurs when adult production exceeds the population goal and viability level. When a population viability is below the viability objective and less than viable, there is less opportunity for direct and indirect harvest. These harvest rates are controlled by ESA harvest impacts limits.

The long term visions and objectives adopted for steelhead in Oregon subbasins call for increasing allowable tribal and non tribal fishing rates on natural populations as the benefits of recovery measures are realized. For instance, allowable harvest on natural populations may be increased as habitat restoration improves fish productivity. Increasing natural population productivity and numbers through implementation of this plan will likely increase the numbers of harvestable wild fish over time and the frequency of years where steelhead populations produce harvestable numbers. Increasing salmonid numbers can also be expected to provide a variety of fishery benefits, including seasons that are more consistent and fewer restrictions to harvest fish of other stocks. Sustainable harvest rates will be based on realized improvements in population viability and productivity. The Mid-Columbia steelhead Sounding Board is currently developing Broad Sense Recovery Goals. The following table was provided to them for their information. This table serves as an interim summary and will be replaced when the Sounding Board completes the development of the Broad Sense Recovery Goals.

Table 5-9. Range of Broad Sense Goals for Oregon Subbasins within the Mid-Columbia River Steelhead ESU.

TRT POPULATIONS	LOCATION	SOURCE	GOALS/OBJECTIVES	DISCUSSION	LINKAGE TO VIABILITY
DESCHUTES POPULATIONS					
The vision for the Deschutes Subbasin is to "promote a healthy, productive watershed that sustains fish, wildlife and plant communities as well as provides economic stability for future generations of people. An inclusive consensus-based process will be used to create a plan for the achievement of sustainable management water quality standards, instream flows, private water rights, fish and wildlife consistent with the customs and quality of life in this basin (NPCC 2004a)."					
Deschutes Eastside Tribs. TRT	Deschutes Eastside Tribs.	Deschutes Subbasin Plan (NPCC 2004a) EDT projections	2,650 natural origin adults (850 in Buck Hollow, 700 in Bakeoven, 1,500 in Trout Cr.)	25-year planning horizon. Based on EDT model results and assumes habitat restoration identified in subbasin plan.	NOAA interim recovery target is 6,300 adult summer steelhead to Deschutes River.
Deschutes Westside Tribs TRT	Deschutes Westside Tribs	Deschutes Subbasin Plan (NPCC 2004a) EDT projections	5,000 naturally produced adults	25-year planning horizon. Based on EDT model results and assumes habitat restoration identified in subbasin plan.	NOAA interim recovery target is 6,300 adult summer steelhead to Deschutes River.
Deschutes Eastside and Westside Tribs. TRTs	To mouth of Deschutes River	Spirit of the Salmon, Tribal Restoration Plan (CRITFC 1996)	Average run size of 16,000 to 22,000 summer steelhead adults and jacks	Escapement allows for annual combined recreational and tribal harvest of 5,000 to 11,000 adults and jacks. Production goal includes expanded natural production into White River drainage above White River Falls.	NOAA interim recovery target is 6,300 adult summer steelhead to Deschutes River.
Deschutes Eastside and Westside Tribs. TRTs	Present range below Pelton/Round Butte Dam	Lower Deschutes River Subbasin Fish Management Plan (ODFW 1997)	Total escapement of 9,089 adults.	ODFW currently manages to this objective (French pers com. 2005). Escapement of 9,089 adults to the mouth would allow some level of harvest. Based on maximum steelhead production capacity estimate of 147,659 smolts in 1997, with an adult spawning escapement of 6,575. CTWS was involved in this planning process and manages to this objective (Gauvin pers com. 2005).	NOAA interim recovery target is 6,300 adult summer steelhead to Deschutes River.
JOHN DAY POPULATIONS					
"The vision for the John Day Subbasin is a healthy and productive landscape where diverse stakeholders from within and outside the subbasin work together to maintain and improve fish and wildlife habitat in a manner that supports the stewardship efforts of local land managers, makes efficient use of resources and respects property rights. The result will be sustainable, resource-based activities that contribute to the social, cultural and economic well-being of the subbasin and the Pacific Northwest (NPCC 2005)."					
Upper Mainstem John Day River	Upper mainstem JD subbasin	John Day Subbasin Plan (NPCC 2005)	Return of 4,269 steelhead.	20 to 25-year planning. Objectives based on percentage of what technical team judged as historic run size. Goal is defined as an average run year.	NOAA interim recovery target is 2,000 adult summer steelhead.
North Fork John day River	North Fork JD subbasin	John Day Subbasin Plan (NPCC 2005)	Return of 10,743 steelhead.	20 to 25-year planning horizon. Objectives based on percentage of what technical team judged as historic run size. Goal is defined as an average run year.	NOAA interim recovery target is 2,700 adult summer steelhead.
Middle Fork John Day River	Middle Fork JD subbasin	John Day Subbasin Plan (NPCC 2005)	Return of 4,592 steelhead.	20 to 25-year planning horizon. Objectives based on percentage of what technical team judged as historic run size. Goal is defined as an average run year.	NOAA interim recovery target is 1,300 adult summer steelhead.
South Fork John Day River	South Fork JD subbasin	John Day Subbasin Plan (NPCC 2005)	Return of 2,346 steelhead.	20 to 25-year planning horizon. Objectives based on percentage of what technical team judged as historic run size. Goal is defined as an average run year.	NOAA interim recovery target is 600 adult summer steelhead.
Lower Mainstem John Day River	Lower mainstem John day subbasin	John Day Subbasin Plan (NPCC 2005)	Return of 7,450 steelhead.	20 to 25-year planning horizon. Objectives based on percentage of what technical team judged as historic run size. Goal is defined as an average run year.	NOAA interim recovery target is 3,200 adult summer steelhead.
Total for all populations in John	To mouth of John Day River	John Day Subbasin Plan (NPCC 2005)	Return of 29,400 adult steelhead	20 to 25-year planning horizon. Objectives based on percentage of what technical team judged as historic run size. Goal is defined as an average run year. Limited	NOAA interim recovery target is 9,800 adult summer steelhead.

TRT POPULATIONS	LOCATION	SOURCE	GOALS/OBJECTIVES	DISCUSSION	LINKAGE TO VIABILITY
Day MPG				fisheries allowed on strongest populations.	
All TRTs in the Jon Day Basin	To the mouth of John Day River	CTUIR (Schwartz pers com. 2005)	Return of 45,000 adult steelhead to the mouth		NOAA interim recovery target is 9,800 adult summer steelhead.
Upper Mainstem John Day River TRT	U. Mainstem John Day River subbasin	US v. Oregon (1998)	Return of 3,235 steelhead	Long term management objective for returning adults, based on 70% maximum equilibrium	NOAA interim recovery target is 2,000 adult summer steelhead.
North Fork John Day River TRT	North Fork John Day River subbasin	US v. Oregon (1998)	Return of 6,780 steelhead	Long term management objective for returning adults, based on 70% maximum equilibrium specified in Chilcote (1998)	NOAA interim recovery target is 2,700 adult summer steelhead.
Middle Fork John Day River TRT	Middle Fork John Day River subbasin	US v. Oregon (1998)	Return of 2,325 steelhead	Long term management objective for returning adults, based on 70% maximum equilibrium	NOAA interim recovery target is 1,300 adult summer steelhead.
South Fork John Day River TRT	South Fork John Day River subbasin	US v. Oregon (1998)	Return of 920 steelhead	Long term management objective for returning adults, based on 70% maximum equilibrium	NOAA interim recovery target is 600 adult summer steelhead.
Lower Mainstem John Day River TRT	Lower mainstem John Day River subbasin	US v. Oregon (1998)	Return of 3,778 steelhead	Long term management objective for returning adults, based on 70% maximum equilibrium	NOAA interim recovery target is 3,200 adult summer steelhead.
All populations in John Day MPG	To mouth of John Day River	US v. Oregon (1998)	Return of 17,038	Long term management objective for returning adults, based on 70% maximum equilibrium	NOAA interim recovery target is 9,800 adult summer steelhead.
FIFTEENMILE CREEK POPULATIONS					
The vision for the Fifteenmile Subbasin is "a healthy, self-sustaining ecosystem of people, fish, wildlife, plants and other natural and cultural resources that provides direct benefits to society and nourishes the spirit (NPCC 2004b)."					
Fifteenmile Creek Winter steelhead	Fifteenmile Cr.	Fifteenmile Creek Subbasin Plan (NPCC 2004b)	Return of 1,270 (268 to 2,274) winter steelhead spawners	Estimated population ranges is based on EDT results and reflects 100% restoration of both in-subbasin and out-of-subbasin conditions.	NOAA Interim recovery target is 500 winter steelhead to Fifteenmile Cr. TRT, including approx. 417 to Fifteenmile Cr.
Fifteenmile Creek Winter steelhead	Mill Creek and other streams	Fifteenmile Creek Subbasin Plan (NPCC 2004b)	Return of 255 (54 to 455) winter steelhead spawners	Estimated population ranges is based on EDT results and reflects 100% restoration of both in-subbasin and out-of-subbasin conditions.	NOAA interim recovery target is 500 winter steelhead to Fifteenmile Cr. TRT, including approx. 83 to Mill Creek and other streams.
UMATILLA RIVER POPULATIONS					
"The vision for the Umatilla/Willow subbasin is a healthy ecosystem with abundant, productive, viable, and diverse populations of aquatic and terrestrial species, which will support sustainable resource-based activities that contribute to the social, cultural, and economic well-being of the communities within the subbasin and the Pacific Northwest (NPCC 2004c)."					
Umatilla TRT population	To mouth of Umatilla R.	US v. Oregon Subbasin Production Reports (1987)	Total return of 7,958 adult steelhead to mouth (4,300 natural, 3,658 hatchery).	Does not specify harvest component.	NOAA interim target is 2,300 summer steelhead.
Umatilla TRT population	To mouth of Umatilla R.	Spirit of the Salmon, Tribal Restoration Plan (CRITIFC 1996)	Total return of 9,670 adults (4,000 natural and 5,670 hatchery)	Provides for average harvest of 5,460 adults.	NOAA interim target is 2,300 summer steelhead.
Umatilla TRT population	To mouth of Umatilla R.	Umatilla Subbasin Summary (ODFW 2001)	Total return of 5,500 adults (4,000 natural and 1,500 hatchery)	Provides for average harvest of 1,384 adults.	NOAA interim target is 2,300 summer steelhead.

TRT POPULATIONS	LOCATION	SOURCE	GOALS/OBJECTIVES	DISCUSSION	LINKAGE TO VIABILITY
Umatilla TRT population	To mouth of Umatilla R.	Umatilla Subbasin Plan (NPCC 2004)	Return of 3,610 naturally produced adults.	10 to 15-year planning horizon. Return estimated by EDT and derived from the PFC analysis in the subbasin plan (sec. 3.6.1.2). Total return objectives using EDT are under development by fisheries managers.	NOAA interim target is 2,300 summer steelhead.
WALLA WALLA RIVER POPULATIONS					
"The vision for the Walla Walla Subbasin is a healthy ecosystem with abundant, productive, and diverse populations of aquatic and terrestrial species that supports the social, cultural and economic well-being of the communities within the Subbasin and the Pacific Northwest (NPCC 2004d)."					
Walla Walla TRT population	To mouth of Walla Walla River	CTUIR objective for Oregon from Walla Walla Subbasin Summary (NPCC 2001)	Return of 2,500 adults (1,500 natural and 1,000 hatchery).	Objective for Oregon subbasin. Production provides average harvest of 920 adults.	NOAA Interim target is 2,600 adult summer steelhead
Walla Walla TRT population	To mouth of Walla Walla River	CTUIR objective for Washington from Walla Walla Subbasin Summary (NPCC 2001)	Return of 3,150 adults (1,500 natural and 1,600 hatchery).	Objective for Washington subbasin. Production provides average harvest of 1,520 adults.	NOAA Interim target is 2,600 adult summer steelhead
Walla Walla TRT population	To mouth of Walla Walla River	ODFW objective for Oregon from Walla Walla Subbasin Summary (NPCC 2001)	Return of 1,500 adults (1,500 natural and 0 hatchery).	Objective for Oregon subbasin. Production does not specify a harvest component.	NOAA Interim target is 2,600 adult summer steelhead
Walla Walla TRT population	To mouth of Walla Walla River	WDFW objective for Washington from Walla Walla Subbasin Summary (NPCC 2001)	Return of 3,150 adults (1,500 natural and 1,600 hatchery).	Objective for Washington subbasin. Production provides average harvest of 1,600 adults. Natural return objective of 1,500 adults is a preliminary estimate.	NOAA Interim target is 2,600 adult summer steelhead
Walla Walla TRT population	To mouth of Walla Walla River	Spirit of the Salmon, Tribal Restoration Plan (CRITIFC 1996)	Return of 11,000 adults (3,000 natural spawners and 7,680 for harvest).	Provides for harvest of 7,680 adults.	NOAA Interim target is 2,600 adult summer steelhead

References: Oregon Department of Fish and Wildlife (1997), Lower Deschutes River Subbasin Fish Management Plan; Northwest Power and Conservation Council (2004a), Deschutes Subbasin Plan; Northwest Power and Conservation Council (2004b), Fifteenmile Creek Subbasin Plan; Northwest Power and Conservation Council (2004c), Umatilla/Willow Subbasin Plan; Northwest Power and Conservation Council (2004d), Wall Walla Subbasin Plan; Northwest Power and Conservation Council (2005), John Day Subbasin Plan; Columbia River Inter-tribal Fish Commission (1996) WY-KAN-USH-MI-WA-KISH-WIT Spirit of the Salmon, the Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes; US v. Oregon Subbasin Production Reports (1987); US v. Oregon (1998); Northwest Power and conservation Council (2001), Umatilla Subbasin Summary; Northwest Power and Conservation Council (2001), Walla Walla Subbasin Summary; French, R., (October 2005), personal communication; Gauvin, M., (September 2005), personal communication; Schwartz, J., (October 2005), personal communication.

Section 6 Current Status—Viability Assessments

This section contains separate viability assessments for the ten extant populations and three MPGs of Mid-Columbia steelhead that exist in Oregon. Data sources and methods to estimate abundance vary considerably between populations and are described within each population assessment. The order of presentation is arranged by Major Population Grouping, starting with the Cascades Eastern Slope Tributary MPG, followed by the John Day River and Umatilla/Walla Walla rivers MPGs.

6.1 Population Viability Assessments

6.1.1 Fifteenmile Creek Steelhead Population

The Fifteenmile Creek steelhead population (Figure 6-1a) is part of the Mid-Columbia Steelhead ESU which has four major population groupings (MPG), including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers, and the Yakima River group. The Fifteenmile population is a winter run and resides in the Cascades Eastern Slope Tributaries MPG. The ESU and this MPG contain three major life history categories: summer run, winter, run and summer-winter run combination. The Fifteenmile population is the only population which is classified as an entirely winter life history type.

The ICTRT classified the Fifteenmile population as an “Intermediate” sized population (Table 6-1a). A steelhead population classified as Intermediate has a mean minimum abundance threshold of 1,000 natural spawners with a sufficient intrinsic productivity (greater than 1.4 recruits per spawner at the threshold abundance level) to achieve a 5% or less risk of extinction over a 100-year timeframe.

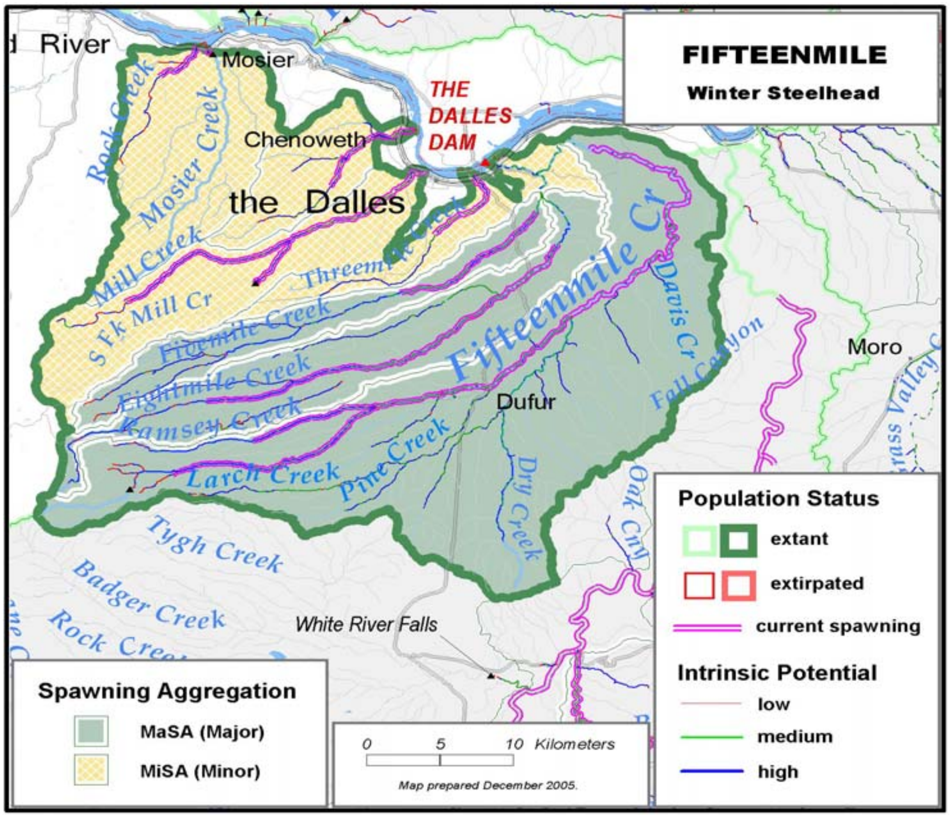


Figure 6.1a. Fifteenmile Creek Winter Steelhead population boundaries and major and minor spawning aggregations. 5-9. Range of Broad Sense Goals for Oregon Subbasins within the Mid-Columbia River Steelhead ESU.

Table 6-1a. Fifteenmile Creek Winter Steelhead basin statistics.

Drainage Area (km2)	1,420
Stream lengths km* (total)	638
Stream lengths km* (below natural barriers)	495
Branched stream area weighted by intrinsic potential (km2)	1.816
Branched stream area km2 (weighted and temp. limited)	1.384
Total stream area weighted by intrinsic potential (km2)	2.006
Total stream area weighted by intrinsic potential (km2) temp limited	1.423
Size / Complexity category	Intermediate / C (trellis pattern)
Number of MaSAs	3
Number of MiSAs	5

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22ºC.

Current Abundance and Productivity

Current (1985 to 2005) abundance (number of adult spawners in natural production areas) has ranged from 130 (1993) to 1,922 (2004) (Figure 6-1b). Estimates of abundance of adult steelhead spawners in the Fifteenmile Creek Subbasin are based on redds observed during single pass spawning ground surveys conducted annually by ODFW and USFS personnel in selected survey units in upper Fifteenmile, Ramsey, and Eightmile creeks from 1985 through 2002. Since 2003, spawning ground surveys have been conducted in three passes over the duration of annual spawning activity in one-mile survey sites selected randomly from five-mile survey units stratified across the currently known spawning habitat in Fifteenmile, Ramsey, Eightmile, and Fivemile creeks. For this analysis, observations of redds and the locations of surveys have been compiled from DePinto et al. (2003), Glenney et al. (2004) and unpublished data (R. French, personal communication, ODFW, The Dalles, 2005). Prior to 2003, we used redd densities in surveyed reaches to estimate redd densities in unsurveyed reaches. The ICTRT intrinsic potential analyses (ICTRT 2005) were used to estimate a redds per weighted m^2 in surveyed reaches. To estimate total redds in the population, we multiply the number of redds per weighted m^2 in surveyed reaches by the total weighted m^2 of currently used habitat in the drainages where reaches were surveyed (ICTRT 2005). Historical intrinsic potential is estimated using a simple GIS-based model that accounts for differences across stream reaches in terms of stream width, gradient, and valley width that is further weighted by habitat quality.

For the 2003 and later years, observations of redds were expanded by the sample rate, both temporally and spatially, to estimate each season's total redds (redds/total spawning area/year). For years when streams in the Fifteenmile Creek Subbasin were not surveyed (most notably Fivemile Creek prior to 2003) assumptions were made that spawning activity in unsurveyed streams was generally evenly distributed and synchronous with the entire population – average proportional relations relative to the Fifteenmile Creek mainstem were used to estimate spawning activity in unsurveyed streams (Fivemile Creek redds represent approximately 15% of the Fifteenmile mainstem redds).

The 2003-2005 multiple pass surveys have shown that spawning times can vary across years. Because the spawning ground surveys prior to 2003 were conducted once per season, variability in the time of spawning may be masked. However, spot checks were conducted to monitor the level of spawning activity to determine when to conduct the surveys and recent investigations have shown that redd life (the length of time new redds remain visible) is sufficiently long to ensure that the observations from the historic single-pass surveys represent total spawning activity for each season (R. French, personal communication, ODFW, The Dalles, 2005). Conversion of an annual total redd count to the adult population from 1985 to present assumes a 2.1 fish per redd. This estimate was developed based on data from Deer Creek, a tributary to the Wallowa River (Personal communication, R. Carmichael, ODFW, La Grande).

To estimate the abundance of adult progeny on the spawning grounds each season, consideration of removals of natural origin fish for hatchery broodstock and natural spawning hatchery origin fish must be accounted for. However, no steelhead hatchery program exists in the Fifteenmile Creek Subbasin and hatchery steelhead are not released in steelhead habitat (Anonymous 2004). Further, hatchery strays in the Fifteenmile Creek Subbasin have rarely been observed and the proportion is near 0%. Consequently for this analysis, the fraction of hatchery fish in the spawning population was assumed to be very low and mathematically assigned as "zero".

Virtually no spawning steelhead in the Fifteenmile Creek Subbasin have been sampled for age-at-return and no population specific information exists to assign natural origin spawning fish into cohorts to estimate abundance of progeny. Therefore, age-at-return information from the closest wild steelhead population with similar winter run traits was used to apportion Fifteenmile steelhead spawners into brood years. Year specific age-at-return for Hood River wild winter steelhead sampled at Powerdale Dam was used. For those years with inadequate sample sizes an average age-at-return by spawning year was applied.

Recent year natural spawners include only natural origin fish. Hatchery strays in the Fifteenmile Creek population have rarely been documented.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 593 (Table 6-1b). During the period 1985-1999, returns per spawner in the Fifteenmile population ranged from 0.32 (1987) to 5.17 (1998). The most recent 15-year (1985-1999) SAR adjusted and median delimited geometric mean of returns per spawner was 2.03 (Table 6-1b).

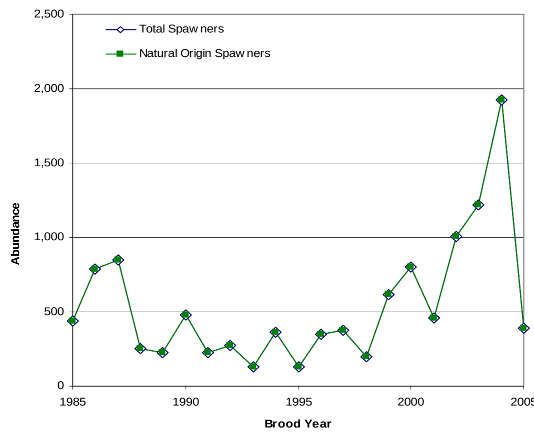


Figure 6-1b. Fifteenmile Creek Steelhead spawner abundance estimates 1985-2005. Estimates based on redd count expansions.

Table 6-1b. Fifteenmile Creek Winter Steelhead abundance and productivity measures.

10-year geomean natural abundance	593
15-year return/spawner productivity	1.21
15-year return/spawner productivity, SAR adjusted, delimited*	2.03
15-year Bev-Holt fit productivity, SAR adjusted	n/a
Lambda productivity estimate	1.01
Average proportion natural origin spawners (recent 10 years)	1.0
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds the population median. This approach attempts to remove density dependence effects that may influence the productivity estimate.

Comparison to the Viability Curve

- Abundance: 10-year geomean natural origin spawners
- Productivity: 15-year geomean R/S (adjusted for marine survival and delimited at 348 spawners)
- Curve: Hockey-Stick curve
- Conclusion: Fifteenmile Winter Steelhead population is at MODERATE RISK based on current abundance and productivity. The point estimate is between the 5% and 25% risk curves.

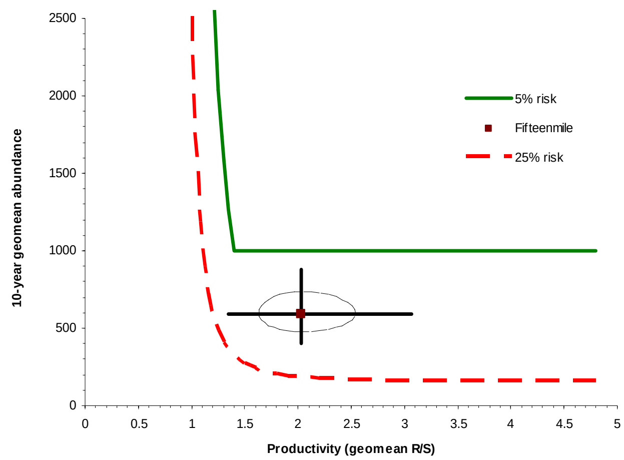


Figure 6-1c. Fifteenmile Winter Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Point estimate shown with a 1 SE ellipse, 1.81XSE abundance line, 1.86XSE productivity line.

Spatial Structure and Diversity

The ICTRT has identified three major spawning areas (MaSAs) and five minor spawning areas (MiSAs) within the Fifteenmile population boundaries. The population boundary extends outside the Fifteenmile Subbasin to encompass the Rock Creek, Mill Creek, and Threemile Creek drainages which directly enter the Columbia River downstream from Fifteenmile Creek (Figure 6-1d). These drainages account for four of the five MiSAs. Current spawning distribution is similar to historic with major production areas in Fifteenmile Creek, Ramsey Creek, Eightmile Creek, and Fivemile Creek.

Spawners within the Fifteenmile population include only natural origin fish. Very few strays have been observed in the population, there is no hatchery program operated within the population, and there are few sources of winter steelhead strays in the Interior Columbia River Basin.

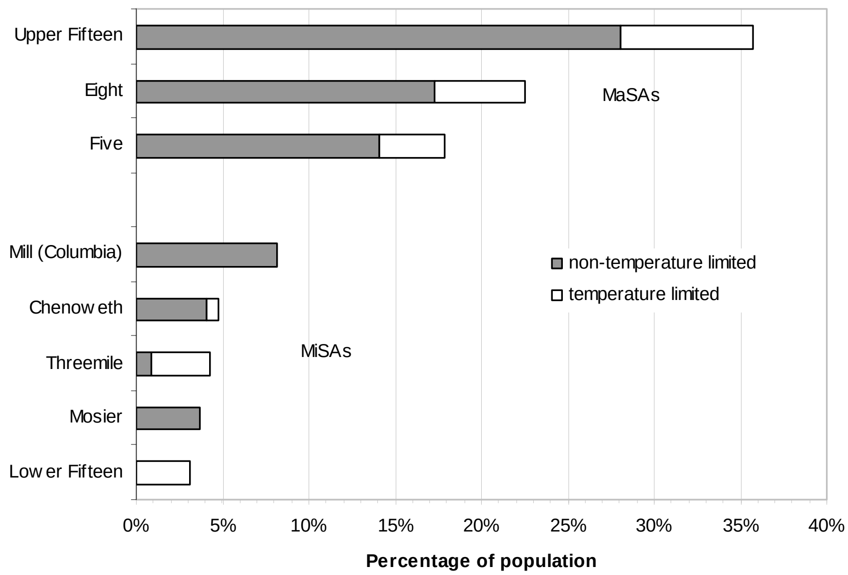


Figure 6-1d. Fifteenmile Creek Winter Steelhead percentage of historical spawning habitat by major/minor spawning area. Temperature limited portions of each MiSA/MaSA are shown in white.

Factors and Metrics

A.1.a Number and spatial arrangement of spawning areas.
The Fifteenmile Creek population has three MaSAs and five MiSAs distributed in a trellis pattern. Historic major production areas included Fifteenmile, Ramsey, Eightmile and Fivemile creeks. Based on the ODFW current spawning distribution database, all three MaSAs and five MiSAs are now occupied. Current distribution is similar to the historic intrinsic potential distribution, with reductions primarily in the southeast tributaries of the Fifteenmile MaSA. The Fifteenmile population rates at **very low risk** because it has three MaSAs occupied and the five MiSAs that equate to greater than 75% of one MaSA.

A.l.b. Spatial extent or range of population.
The current spawner distribution mirrors the historic distribution with all MaSAs and MiSAs currently occupied (Figure 6-1e). The risk rating is **very low** because the current spawning distribution mirrors the historic distribution. Spawning ground survey data is available for Fifteenmile, Ramsey, and Eightmile creeks for 1985-2005. We will conduct additional analyses at a later date to assess occupancy based on this recent survey data.

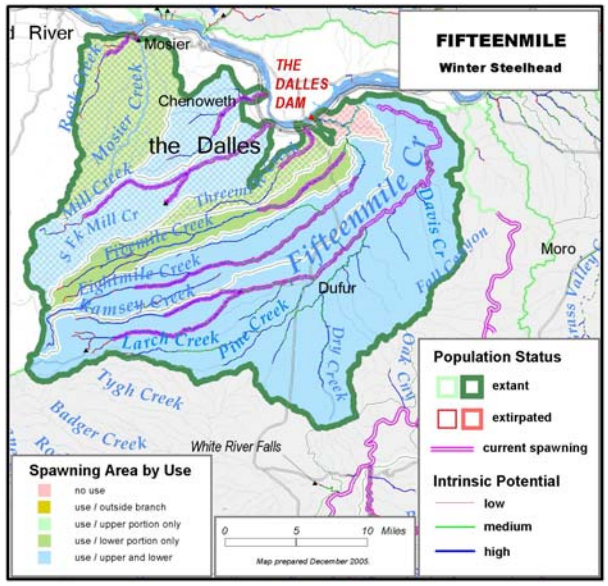


Figure 6-1e. Fifteenmile Creek Winter Steelhead distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.
There has been little change in gaps between current and historical distribution. The population is rated at **very low risk** because all historical MaSAs are occupied, gap distance and continuity has changed little, and there has been no increase in distance between this population and other Mid-Columbia ESU populations.

B.1.a. Major life history strategies.
There are limited data to allow any direct comparisons between historic life history strategies and current strategies. Flow and temperature changes have likely influenced movement pathways and continuity of habitat for juvenile steelhead. Some middle and lower mainstem reaches become uninhabitable during low flow summer periods. We infer that these habitat changes have truncated spawn timing and somewhat limited juvenile rearing diversity. Although these changes have had some influence on life history strategies, they have not likely influenced major strategies. The anadromous form of *O.mykiss* currently persists in the population, and the winter run characteristics have been maintained. We hypothesize that all historic major life history pathways are present, although the mean and variability may have shifted slightly. The rating is **low risk** for this metric.

B.1.b. Phenotypic variation.
We have no direct evidence for loss or substantial change in phenotypic traits. However, changes in flow patterns and temperature profile within Fifteenmile Subbasin have likely reduced variation in both juvenile migration timing and adult spawn timing. We hypothesize that low flows and elevated water temperatures result in a narrower window for successful smolt outmigration as well as truncation of adult spawn timing. Based on inference from habitat changes we have rated the Fifteenmile population at **low risk**.

B.1.c. Genetic variation.
Genetics data consists of samples from two locations within the Fifteenmile population, Eightmile and Fifteenmile creeks. This genetics information indicates that the Fifteenmile population is well differentiated from other populations in the Cascades Eastern Slope Tributaries MPG. Samples within the population from Eightmile Creek are also substantially differentiated from Fifteenmile Creek indicating within population variation. We have rated this metric as **low risk.** Additional samples collected in 2005 from multiple locations within the population will provide a better information base to assess this metric in the future.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. The sources of out-of-ESU winter steelhead strays would be from the Hood River hatchery program, releases in the White Salmon River, and other hatcheries downstream from Hood River. We have documented very few strays, thus the rating is **low risk**.

(2) *Out-of-MPG within ESU strays*. There are no out-of-MPG within ESU winter hatchery programs, thus the rating is **very low risk**.

(3) *Out-of-population within MPG strays*. The only source of within MPG out-of-population strays would be from the Klickitat winter steelhead hatchery program. Since very few strays have been documented and their source is unknown, we have rated this metric as **low risk**.

(4) *Within-population strays*. There is no within population hatchery program. This metric rated **very low risk**.

B.3.a. Distribution of population across habitat types.
The intrinsic potential distribution encompassed five Level 4 ecoregions, of which four accounted for 10% or more of the distribution (Figure 6-1f). Although there have been reductions in the proportional distribution of Grande Fir Mixed Forest and Umatilla Plateau ecoregions, these reductions were not substantial. The population rates at **very low risk**.

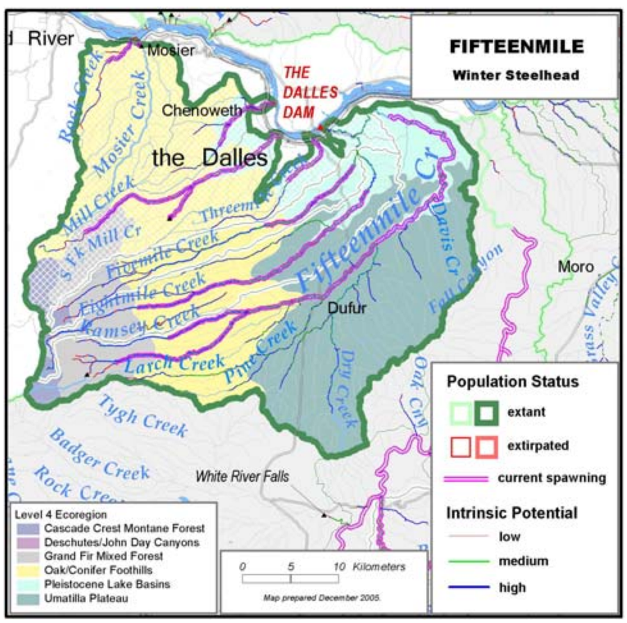


Figure 6-1f. Fifteenmile Creek Winter Steelhead population distribution across various ecoregions.

Table 6-1c. Fifteenmile Creek Winter Steelhead – proportion of spawning area across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Cascade Crest Montane Forest	1.5	0.0
Grand Fir Mixed Forest	14.7	7.1
Oak/Conifer Foothills	48.5	47.5
Pleistocene Lake Basins	16.7	33.6
Umatilla Plateau	18.5	11.7

B.4.a. Selective change in natural processes or selective impacts.
Hydropower system: The hydrosystem and associated reservoirs impose some selective mortality on outmigrating smolts. The magnitude of selective mortality and proportion of the population affected is unknown. The selective mortality is not likely to remove more than 25% of the affected individuals, thus the population rates at **low risk**.

Harvest: Recent allowable harvest rates for winter steelhead in the Mid-Columbia ESU have been below 15%, with actual exploitation rates from 2003-2005 less than 10%. The net fisheries do impose some selective harvest for larger fish; however, the magnitude of harvest considered with the degree of selectivity does not result in a selective mortality of 25% or greater for larger fish. There is no in-basin recreational harvest of Fifteenmile winter steelhead, thus the rating is **low risk**.

Hatcheries: There are no steelhead hatchery programs operated within the population, thus we have rated the population at **very low risk**.

Habitat: Habitat changes which likely impose selective mortality at juvenile life stages. Mainstem summer temperatures and flows in some reaches are unsuitable for rearing and survival. Juveniles which move into the mainstem to rear during summer would be subject to high mortality rates. It is likely that these selective mortality rates do not impact a substantial component of the population, thus we have rated the population at **low risk**.

Spatial Structure and Diversity Summary

The integrated Spatial Structure/Diversity rating is low risk (Table 6-1d) for the Fifteenmile population. There has been little change in distribution relative to the historic distribution. The absence of major reductions in distribution resulted in a rating of very low risk for spatial structure metrics. We hypothesize that there have been minor reductions in life history diversity and phenotypic variation, but these changes are not severe enough to raise risk levels to moderate. There are few hatchery fish in the population resulting in low risk for spawner composition.

Table 6-1d. Spatial structure and diversity scoring table.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Mean = 2.0 Very Low Risk	Very Low Risk	**Low Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	VL (2)	VL (2)			
B.1.a	L (1)	L (1)	Low Risk	Low Risk	
B.1.b	L (1)	L (1))			
B.1.c	L (1)	L (1)			
B.2.a(1)	L (1)	Low Risk (1)	Low Risk (1)		
B.2.a(2)	VL (2)				
B.2.a(3)	L (1)				
B.2.a(4)	VL (2)				
B.3.a	VL (2)	VL (2)	VL (2)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The Fifteenmile Creek population does not currently meet viability criteria because the Abundance/Productivity risk rating is moderate (Figure 6-1g). The recent 10-year geometric mean abundance point estimate is only 59.3% of the threshold abundance of 1,000, thus the overall Abundance/Productivity rating is moderate. The overall Spatial Structure/Diversity rating is low risk. A significant increase in the 10-year geometric mean abundance is required to improve the Abundance/Productivity risk level to low and result in achievement of viable status.

Abundance/ Productivity Risk	Spatial Structure/Diversity Risk: Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	
Low (<5%)	V	V	MV	
Moderate (6-25%)		Fifteenmile		
High >(25%)				

Figure 6-1g. Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV= Minimally Viable; NV=Not Viable

Fifteenmile Creek Steelhead – Data Summary

Data type: Redd count expansions
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 6-1e. Fifteenmile Creek Steelhead run data (used for curve fits and R/S analysis). Entries where the spawner number is less than the median escapement (1985-1999) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1985	435	1.0	435	288	0.66	0.46	190	0.44
1986	791	1.0	791	394	0.50	0.94	768	0.97
1987	852	1.0	852	269	0.32	2.18	1051	1.23
1988	**251**	**1.0**	**251**	**250**	**0.99**	**0.99**	**313**	**1.25**
1989	**225**	**1.0**	**225**	**160**	**0.71**	**0.96**	**175**	**0.78**
1990	479	1.0	479	313	0.65	2.83	1064	2.22
1991	**223**	**1.0**	**223**	**164**	**0.73**	**2.33**	**709**	**3.18**
1992	**271**	**1.0**	**271**	**339**	**1.25**	**1.88**	**1395**	**5.14**
1993	**130**	**1.0**	**130**	**389**	**3.00**	**1.18**	**915**	**7.07**
1994	366	1.0	366	273	0.75	1.07	495	1.35
1995	**130**	**1.0**	**130**	**430**	**3.32**	**1.23**	**1065**	**8.22**
1996	**348**	**1.0**	**348**	**995**	**2.86**	**1.03**	**1940**	**5.58**
1997	379	1.0	379	594	1.56	0.76	907	2.39
1998	**196**	**1.0**	**196**	**1,015**	**5.17**	**0.49**	**897**	**4.57**
1999	617	1.0	617	1,353	2.19	0.52	749	1.21
2000	803	1.0	803					
2001	457	1.0	457					
2002	1,009	1.0	1,009					
2003	1,220	1.0	1,220					
2004	1,922	1.0	1,922					
2005	388	1.0	388					

Table 6-1f. Geomean abundance and productivity estimates. Current abundance and productivity values are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1988-1999	1985-1999	geomean
Point Est.	1.77	1.43	2.03	1.49	1.10	1.04	593
Std. Err.	0.27	0.20	0.22	0.21	0.06	0.11	0.22
count	8	8	8	8	12	15	10

Table 6-1g. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.21	0.24	n/a	n/a	0.48	0.47	40.3	1.31	0.25	n/a	n/a	0.47	0.39	38.7
Const. Rec	392	62	n/a	n/a	n/a	n/a	33.1	425	62	n/a	n/a	n/a	n/a	30.4
Bev-Holt	13.11	38.76	438	166	0.21	0.67	36.1	18.75	76.66	463	176	0.32	0.02	33.5
Hock-Stk	3.10	0.00	126	0	0.22	0.66	36.2	1.87	0.47	261	85	0.38	0.05	36.3
Ricker	2.78	0.91	0.00220	0.00075	0.26	0.59	36.7	2.88	0.89	0.00207	0.00071	0.35	0.01	35.1

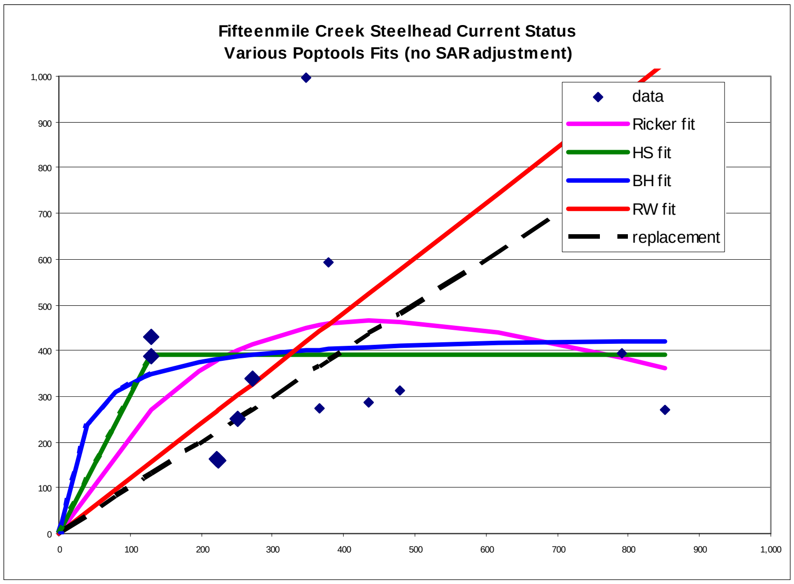


Figure 6-1h. Stock-recruitment curves for the Fifteenmile Creek Steelhead population. Data not adjusted for marine survival.

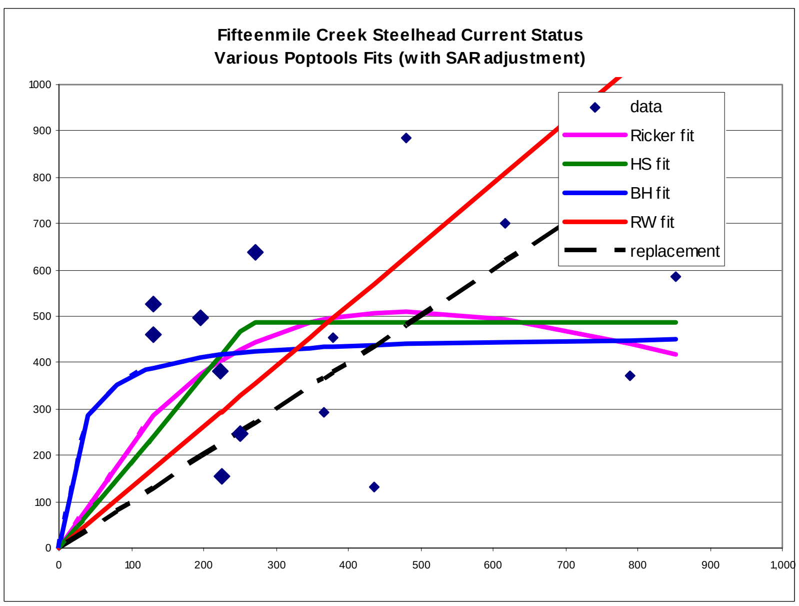


Figure 6-1i. Stock-recruitment curves for the Fifteenmile Creek Steelhead population. Data adjusted for marine survival.

6.1.2 Deschutes River Eastside Steelhead Population

The Deschutes River Eastside Steelhead population (Figure 6-2a) is part of the Mid-Columbia Steelhead ESU which has four major population groupings, including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers and the Yakima River group. There are three life history categories in the ESU: summer run, winter run, and summer-winter run combination. The Deschutes Eastside population is a summer run and resides in the Cascades Eastern Slope Tributaries MPG.

The ICTRT classified the Deschutes Eastside population as an "Intermediate" sized population (Table 6-2a). A steelhead population classified as intermediate has a mean minimum abundance threshold of 1,000 natural spawners with a sufficient intrinsic productivity (greater than 1.4 recruits per spawner at the threshold abundance level) to achieve a 5% or less risk of extinction over a 100-year timeframe.

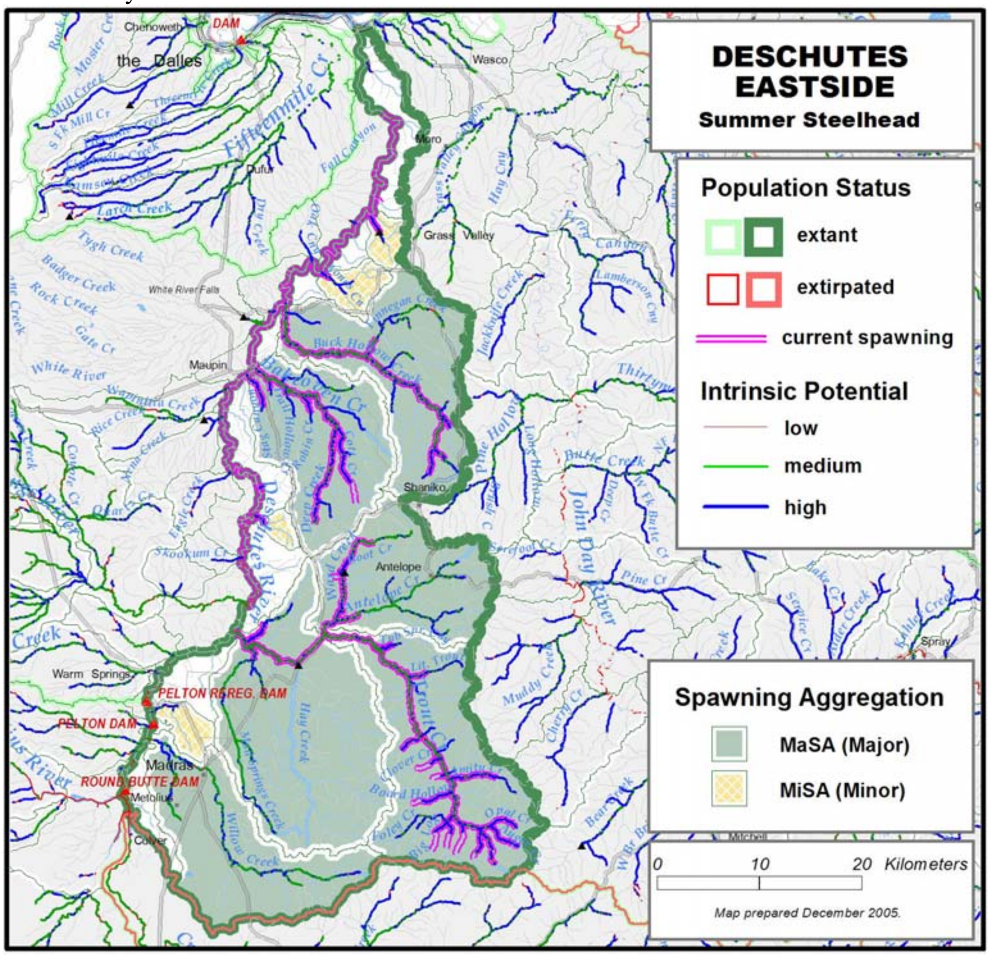


Figure 6-2a. Deschutes River Eastside Steelhead population boundaries and major and minor spawning areas.

Table 6-2a. Deschutes River Eastside Steelhead Basin Statistics

Drainage Area (km2)	3,889
Stream lengths km* (total)	974
Stream lengths km* (below natural barriers)	884
Branched stream area weighted by intrinsic potential (km2)	2.595
Branched stream area km2 (weighted and temp. limited)	1.784
Total stream area weighted by intrinsic potential (km2)	2.999
Total stream area weighted by intrinsic potential (km2) temp limited	1.939
Size / Complexity category	Intermediate / B (dendritic structure)
Number of MaSAs	6
Number of MiSAs	4

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22ºC.

Current Abundance and Productivity

Current (1990 to 2005) abundance (number of adult spawners in natural production areas) has ranged from 723 (1993) to 10,079 (2001) (Figure 6-2b). We examined two approaches for estimating the abundance of natural and hatchery origin steelhead in the Deschutes River Eastside population and selected one for this viability assessment. The first approach is similar to that used by Chilcote (2001) who conducted stock recruitment analyses for the combined Deschutes Eastside and Westside populations. This method used the following information: estimated number of steelhead that pass above Sherars Falls (from mark-recapture estimates), the number of fish recovered in fisheries and traps above Sherars Falls, and estimated fall back rate for hatchery fish. We conducted similar analyses for the Deschutes Eastside population with the additional step of subtracting out the Westside population abundance estimates. We found that this approach yielded, what appeared to be, extremely high abundance estimates of both natural and hatchery spawners for the Deschutes Eastside population. Using this method results in a large number of spawners that would have to be in the mainstem Deschutes River. These mainstem abundance estimates are not consistent with the two years of redd observations in the mainstem. We were unable to adequately quantify Sherars Falls fall back rates for natural and hatchery origin fish. The Sherars Falls mark recapture subtraction approach is very sensitive to the fall back estimates and without accurate estimates we chose to use an alternative approach.

We chose to assess abundance and productivity based on estimates of spawners in the tributary production areas including Buck Hollow Creek, Bakeoven Creek, and Trout Creek. We acknowledge that this approach does not account for mainstem abundance and productivity. However, we believe this approach provides a better representation of the abundance and productivity for the Deschutes Eastside population.

Estimates of the abundance of steelhead in the tributary production areas of the eastside population are based on single pass index spawning ground surveys in the major spawning areas (MaSAs) of Trout, Bakeoven, and Buck Hollow creeks. Annual observations of redds begin with the 1990 spawning year in Bakeoven and Buck Hollow creeks, and 1993 in Trout Creek (excluding 1994). Spawning also occurs in the mainstem, but only two surveys have been conducted in the mainstem downstream of Trout Creek and this portion of the eastside population is not included in this assessment.

To estimate spawning abundance, observed redd densities (redds/m^2) were extrapolated to unsurveyed areas of currently occupied spawning habitat. Variability in spawning habitat capacity is incorporated in the abundance estimate by using the Interior Columbia Basin TRT's historical intrinsic potential to expand redd observations per unit survey area to unsurveyed areas (ICTRT 2005). The redds per weighted m^2 of intrinsic habitat in the index survey areas are multiplied by the total m^2 of weighed intrinsic habitat within each tributary production area. Total redds are determined as the sum of redds in Bakeoven, Buck Hollow, and Trout creeks. In Trout Creek in 1990-1992 and 1994, when surveys were not conducted, the Trout Creek abundance was assumed to be 62% of the Buck Hollow and Bakeoven abundance estimates, based on the proportion of spawning habitat in Trout Creek relative to all three tributaries. Redds are expanded to fish by multiplying total redds by 2.1 fish per redd (personal communication, R. Carmichael, ODFW, La Grande). This estimate was derived for summer steelhead in Deer Creek, a tributary of the Wallowa River.

Abundance of progeny by spawning year was estimated by apportioning the total spawning abundance estimate into hatchery and wild origin fish. For years when at least 10 fish were examined for the presence of adipose fins in each stream, the marked fish proportion was used for the hatchery fraction. Field observers believe that these estimates may be biased low because of difficulties observing adipose fins on live fish at a distance (personal communication, Rod French, ODFW, The Dalles). For years when fewer than 10 fish were observed, the hatchery fraction was estimated based on the relationship between hatchery fraction in Buck Hollow and Bakeoven creeks and Sherars Falls. For Trout Creek we used the relationship of hatchery fraction between Trout Creek and Warm Springs National Fish Hatchery.

Virtually no spawning steelhead in the Deschutes Eastside population have been sampled for age at return and no population specific information exists to assign natural origin spawning fish into cohorts to estimate the abundance of progeny (Anonymous 2004). Age structure information used to estimate progeny by brood year was based on the average of a two-year sample of scales from wild adult steelhead (N=100) collected in the lower Deschutes River (Olsen et al. 1991).

Recent year natural spawners include returns originating from naturally spawning parents, strays from the Deschutes Subbasin Round Butte Hatchery program, and a significant number of out-of-ESU hatchery strays from the Snake River Basin. Spawners originating from naturally spawning parents have comprised an average of 66% of naturally spawning fish since 1990. The percentage of natural origin spawners has ranged from 10% to 88%.

Abundance in recent years has been moderately variable. The most recent 10-year geomean number of natural origin spawners was 1,579. During the period 1990-1999, returns per spawner for steelhead in the Deschutes River Eastside ranged from 0.23 (1991) to 3.83 (1996). The most recent 10-year (1990-1999) geometric mean of returns per spawner SAR adjusted and median delimited was 1.51 (Table 6-2b).

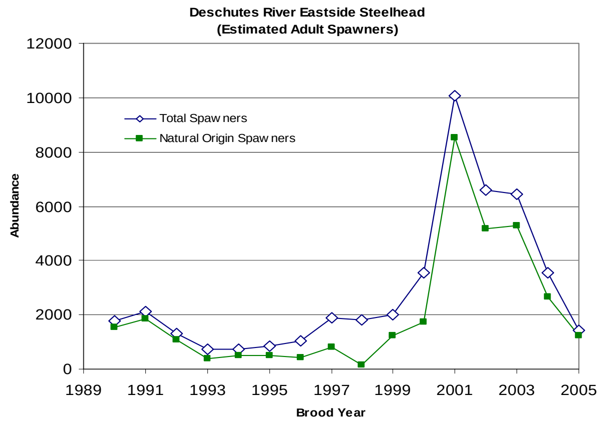


Figure 6-2b. Deschutes River Eastside Steelhead spawner abundance estimates 1990-2005. Estimates based on redd count

Table 6-2b. Deschutes River Eastside steelhead abundance and productivity measures.

10-year geomean natural abundance	1,579
10-year return/spawner productivity	1.14
10-year return/spawner productivity, SAR adj. and delimited* at the median	1.51
20-year Bev-Holt fit productivity, SAR adjusted	2.20 (1.78 @ 20% equilibrium)
Lambda productivity estimate	1.10
Average proportion natural origin spawners (recent 10 years)	0.61
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds the median. This approach attempts to remove density dependence effects that may influence the productivity estimate.

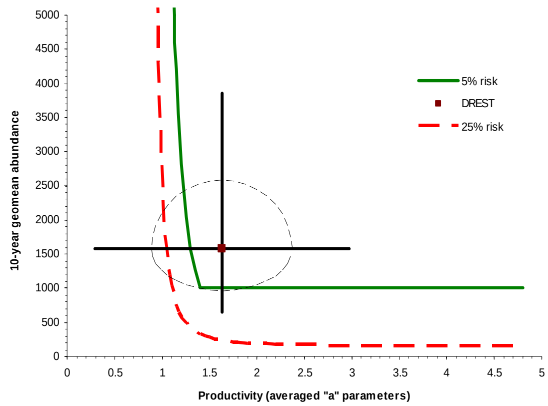


Figure 6-2c. Deschutes River Eastside Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Productivity estimate is averaged Beverton-Holt, Hockey Stick, and Ricker "a" parameters (Bev-Holt and Ricker at 20% equilibrium), and adjusted for marine survival. Estimate shown with a 1 SE ellipse, 1.81 X SE abundance error bar, and 1.81 X SE productivity error bar.

Comparison to the Viability Curve

- Abundance: 10-year geomean natural origin spawners
- Productivity: Averaged Beverton-Holt, Hockey Stick, and Ricker curve fits (Bev-Holt and Ricker at 20% equilibrium), and adjusted for marine survival.
- Curve: Hockey-Stick curve
- Conclusion: The Deschutes River Eastside population is at **MODERATE RISK** based on current abundance and productivity. The point estimate for productivity resides above the 5% curve, but the adjusted productivity standard error bar extends below the 25% curve (Figure 6-2c). The abundance is at low risk because the point estimate is above the 5% risk curve and the lower end of the adjusted standard error is above the 25% risk level.

Spatial Structure and Diversity

The ICTRT has identified six major spawning areas (MaSAs) and four minor spawning areas (MiSAs) within the Deschutes River Eastside Steelhead population (Figure 6-2d). The population boundaries extend above the Pelton Dams, and therefore include areas that are currently inaccessible. One MaSA (Willow Creek) and one MiSA (Campbell) exist in the inaccessible area. The intrinsic potential analysis did not rate the Deschutes River mainstem as spawning habitat because the width was larger than the upper width of the threshold. Spawning is distributed broadly throughout the population boundaries. Steelhead production is concentrated in Buck Hollow, Bakeoven and Trout creeks, with some spawning in the mainstem from Trout Creek to Buck Hollow Creek. Spawners within the Deschutes Eastside population include natural origin returns, hatchery returns from Deschutes River origin fish produced from Round Butte Hatchery, and out-of-ESU hatchery strays primarily from the Snake River Basin. Hatchery origin fish comprise a significant proportion of the natural spawners.

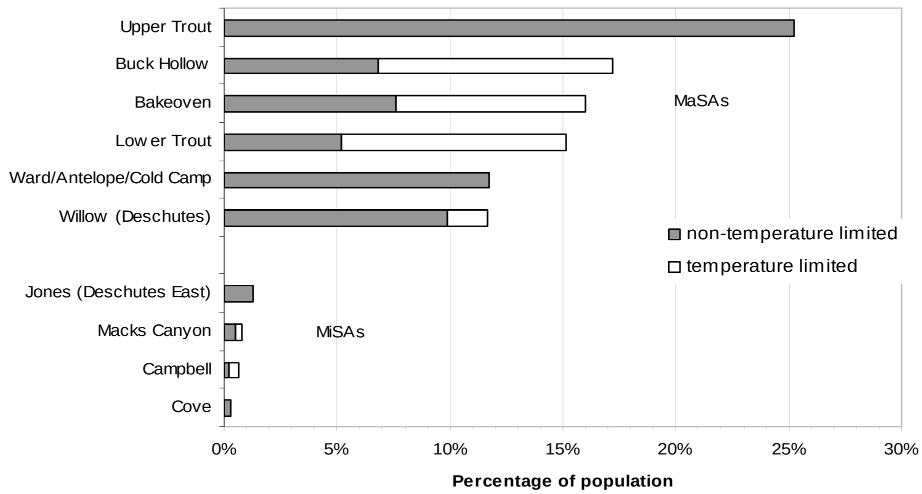


Figure 6-2d. Percentage of historical spawning habitat by major/minor spawning area in the Deschutes River Eastside population.

Factors and Metrics

<u>A.1.a. Number and spatial arrangement of spawning areas</u>.
The Deschutes River Eastside population has six MaSAs and four MiSAs distributed in a dendritic pattern. The primary production areas include Buck Hollow, Bakeoven, and Trout creeks. Historically, Willow Creek was also a significant production area. Based on the ODFW current spawner distribution database, only three of the six MaSAs and three of the four MiSAs are currently occupied. The three MaSAs that do no meet the occupancy criteria include Ward/Antelope, Lower Trout and Willow. Ward/Antelope does not meet the criteria because there is not current use in the upper reaches of Antelope Creek. The Lower Trout does not meet occupancy criteria because there is no current use in the middle and upper reaches of Mud Springs Creek. Willow Creek is unoccupied because it is inaccessible. The Deschutes River Eastside population rates at **low risk** for this metric because it has only three MaSAs occupied and the sum of its MiSAs does not equal 75% of one MaSA.

A.l.b. Spatial extent or range of population.

The current spawner distribution is restricted somewhat from the historical distribution. The Willow Creek MaSA is unoccupied because it is inaccessible. Loss of spawning in the upper Mud Springs Creek and upper Antelope Creek has also reduced the range and extent of distribution (Figure 6-2e). The population is rated at **moderate risk** for this metric because only 50% of the historic MaSAs are currently occupied. Recent spawning ground survey results will be analyzed for future viability assessments.

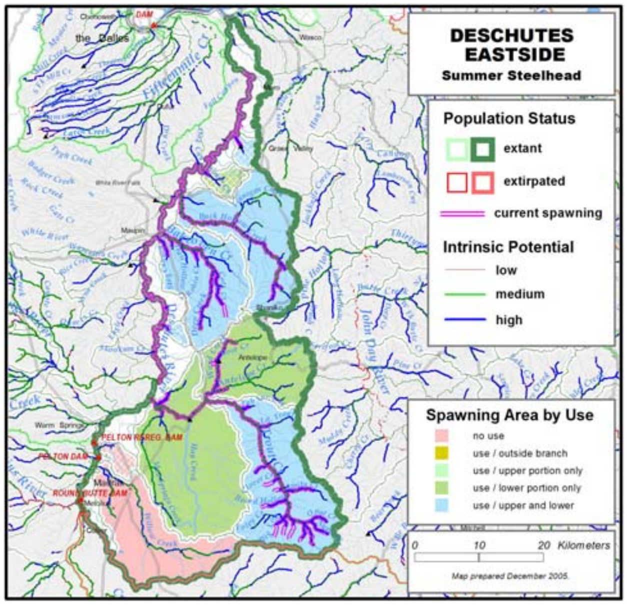


Figure 6-2e. Deschutes River Eastside Steelhead distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.

The loss of spawning in the Willow Creek drainage has caused a significant increase in the gap distance between the uppermost spawning in the population and the middle production areas in Trout Creek. Based strictly on the criteria this population would rate at moderate risk for gaps because less than 75% of the historical MaSAs meet occupancy criteria. However, two of these MaSAs, Ward/Antelope and Lower Trout have significant spawning in the lower reaches and do not meet the occupancy criteria because of loss of spawning in the upper reaches. Currently, with the exception of the gap created by loss of spawning in Willow Creek, there is little difference in gaps and continuity between the historic and current distributions. We have rated the population at **low risk** for this metric.

B.1.a. Major life history strategies.

There are no data to allow any direct comparison of historic and current major life history patterns, thus we must infer from habitat information. Flow and temperature changes within the major spawning tributaries have changed significantly relative to historic conditions with lower summer flows and higher temperatures. These changes have resulted in shifts in juvenile rearing patterns, with less summer rearing capacity in the tributaries and mandatory movement into the mainstem or to upper reaches for periods of summer rearing. Adult migration and spawn timing have likely been impacted by flow and temperature changes. Based on scale analyses of Deschutes fish collected from the mainstem, the population demonstrates multiple ages at smolt migration and ocean residence time as well as repeat spawning. The habitat conditions, with mainstem rearing opportunities, do provide for opportunity for diverse life history strategies. We have rated the population at **low risk** for this metric.

B.1.b. Phenotypic variation.
We have no direct observations to assess loss or substantial change in phenotypic traits, thus we must infer from habitat conditions and habitat changes through time. The flow and temperature changes in the tributaries have likely influenced both adult and juvenile migration timing and patterns. The loss of summer rearing opportunities forces juveniles to move downstream into the mainstem. Adult run-timing through the tributaries, as well as spawn timing, has likely been narrowed considerably. We have rated this metric at **moderate risk** because two or more traits have likely changed and have reduced variability.

B.1.c. Genetic variation.
There are limited genetics data for the Deschutes Eastside population. The lower East Folley Creek samples were not significantly differentiated from other Eastside, Westside, or Round Butte Hatchery samples. However, the remaining samples from eastside tributaries show levels of differentiation between each other and between other populations that are consistent with a relatively unchanged structure. As a result of these data the population is rated at **low risk** for this metric. The ongoing genetics study that the USFWS and co-managers are undertaking will yield additional and better information to assess this metric in the future.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. There are a significant number of out-of-ESU strays spawning naturally in the Deschutes Eastside population. Estimates for stray hatchery proportions are derived from observations in Buck Hollow, Bakeoven, and Trout creeks. Since 1990, we estimated that hatchery strays have comprised from 12-90% of the spawners in this population, with a mean of 34.4% annually. We have no direct estimate of the proportion of out-of-ESU and Round Butte Hatchery strays for this population. Assuming the same proportion of out-of-ESU strays as we did for the Deschutes Westside population (based on observations at Warm Springs National Fish Hatchery), we estimate that an average of 29% of the spawners in the Deschutes Eastside population were out-of-ESU strays. Given this proportion and the duration of the influence we have rated the population at **very high risk** for this metric.

(2) *Out-of-MPG strays from within the ESU*. There have been few out-of-MPG within ESU strays recovered in the Deschutes River. The only source of this type of stray steelhead is from the Umatilla Hatchery program. We have rated this metric as **very low risk** due to the low proportion.

(3) *Out of population within MPG strays*. Strays originating from the Round Butte Hatchery program are considered out-of-population within MPG strays because their origin includes fish captured at Pelton ladder and at Sherars Falls. The broodstock source likely includes both westside and eastside populations. Based on a total average hatchery proportion of 34.4% and the average proportion that Round Butte Hatchery strays make up of the total strays at Warm Springs National Fish Hatchery (15.5%), we estimated that Round Butte Hatchery strays comprise 5.4% of the natural spawning fish annually. We have rated this metric as **moderate risk**.

(4) *Within-population hatchery spawners*. There are no within-population hatchery fish produced, thus we have rated this metric as **very low risk**.

B.3.a. Distribution of population across habitat types.

The intrinsic potential distribution encompassed five Level 4 ecoregions of which four accounted for greater than 10% of the distribution. The current distribution is significantly reduced from the historic distribution (Figure 6-2f). This change has resulted in a substantial reduction in the proportion of the distribution in the Deschutes River Valley ecoregion (Table 6-2c). We have rated this metric at **low risk** because there were four historic ecoregions occupied and there has been a substantial change in one of the four.

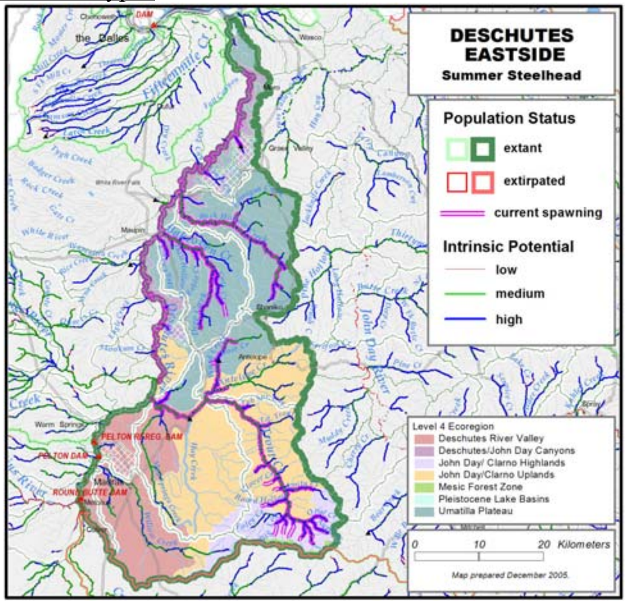


Figure 6-2f. Deschutes River Eastside Summer Steelhead population distribution across various ecoregions.

Table 6-2c. Deschutes River Eastside Steelhead—proportion of spawning area across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Deschutes River Valley	21.5	9.8
Deschutes / John Day Canyons	24.6	29.5
John Day Clarno Highlands	8.5	8.9
John Day Clarno Uplands	29.0	37.7
Umatilla Plateau	16.3	14.1

B.4.a. Selective change in natural processes or selective impacts.
Hydropower system: The hydropower system and associated reservoirs impose some selective mortality on both juvenile and adults during migration. The magnitude of the mortality and the specific components of the population that are affected are unknown. The mortality is not likely to remove more than 25% of any specific component of the population, thus we have rated this metric as **low risk**.

Harvest: Recent mainstem harvest rates for group A steelhead have been generally less that 10% of the aggregate annually. Although some harvest may be size selective for larger fish, the selective mortality would not approach the 25% required to raise the risk level to moderate. There are no natural origin fish harvested in the recreational fishery and only a small proportion of natural fish are impacted by catch and release. The Tribal fishery does not a impose a selective impact. We have rated this metric as **low risk**.

Hatcheries: There are not hatchery fish collected for broodstock from this population. We have rated the population as **very low risk** for this metric.

Habitat: Hydrograph and temperature changes within the tributary spawning and rearing areas likely impose selective mortality. Juveniles that remain in lower reaches of the tributary production areas are subject to harsh conditions that would result in mortality. However, mainstem reaches downstream provide suitable year-round rearing. These mortality factors, although selective, are not likely to remove 25% of the individuals because most would seek alternative habitats for rearing. We have rated this metric as **low risk**.

Spatial Structure and Diversity Summary

The integrated Spatial Structure/Diversity rating is moderate risk for the Deschutes Eastside population (Table 6-2d). The rating for Goal A "allowing natural rates and levels of spatially mediated processes" was low risk. Although the overall rating for this goal was low, spawning distribution is reduced significantly from the historic distribution with loss of spawning in the Willow Creek drainage being the primary factor. The population remains broadly distributed with little change in gaps and good continuity within the currently accessible habitat.

The rating for Goal B "maintaining natural levels of variation" was moderate risk. Habitat changes in key tributary production areas have likely resulted in limitations to life history diversity and reduction in phenotypic expression. In addition, a significant proportion of natural spawners are out-of-ESU strays which resulted in a high risk rating for the spawner composition metric. Additional genetics information is needed to assess within and between population differentiation, as well as to improve our understanding of the degree of introgression of out-of-ESU strays. The ongoing genetics work of the USFWS and co-managers will provide the information needed to better assess the genetic health of this population.

Table 6-2d. Spatial structure and diversity scoring table.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	L (1)	L (1)	Mean=(.67) Low Risk	Low Risk (.67)	**Moderate Risk**
A.1.b	M (0)	M (0)			
A.1.c	L (1)	L (1)			
B.1.a	L (1)	L (1)	Moderate	Mean=(0.5) Moderate Risk	
B.1.b	M (0)	M (0)			
B.1.c	L (1)	L (1)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	VL (2)				
B.2.a(3)	M (0)				
B.2.a(4)	VL (2)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The overall rating for the Deschutes River Eastside population does not currently meet the ICTRT recommendation for viability (Figure 6-2g). The 10-year geomean of natural fish abundance of 1,579 is well above the threshold of 1,000. The point estimate of productivity (1.78 averaged “a” parameter) is above the minimum required at threshold abundance, however the adjusted error term extends well below the 25% risk level. This wide standard error results in a moderate risk level for abundance/productivity. The spatial structure/diversity rating is moderate risk. This is primarily a result of the influence of habitat changes on life history and phenotypic expression as well as out-of-ESU hatchery strays.

Spatial Structure/Diversity Risk

Abundance/ Productivity Risk	Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	
Low (<5%)	V	V	MV	
Moderate (6-25%)		Deschutes Eastside		
High >(25%)				

Figure 6-2g. Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV= Minimally Viable.

Eastside Deschutes River Steelhead – Data Summary

Data type: Index redd counts expanded by intrinsic potential
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 6-2e. Eastside Deschutes River Steelhead run data (used for curve fits and R/S analysis). Entries where the spawner number is less than the median escapement (1990-1999) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1990	1767	0.87	1530	497	0.28	2.83	1406	0.80
1991	2122	0.88	1862	488	0.23	2.33	1139	0.54
1992	**1313**	**0.82**	**1070**	**542**	**0.41**	**1.88**	**1018**	**0.78**
1993	**723**	**0.54**	**388**	**624**	**0.86**	**1.18**	**737**	**1.02**
1994	**729**	**0.70**	**512**	**694**	**0.95**	**1.07**	**743**	**1.02**
1995	**840**	**0.59**	**496**	**1704**	**2.03**	**1.23**	**2088**	**2.49**
1996	**1027**	**0.41**	**424**	**3931**	**3.83**	**1.03**	**4057**	**3.95**
1997	1887	0.43	814	6815	3.61	0.76	5202	2.76
1998	1795	0.10	172	5277	2.94	0.49	2587	1.44
1999	1993	0.62	1226	4228	2.12	0.52	2189	1.10
2000	3538	0.49	1720					
2001	10079	0.84	8509					
2002	6617	0.78	5181					
2003	6444	0.82	5278					
2004	3565	0.74	2652					
2005	1419	0.87	1240					

Table 6-2f. Geomean abundance and productivity estimates

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	all	median	all	1990-1999	1980-1999	geomean
Point Est.	1.21	1.14	1.51	1.31	1.10	n/a	1579
Std. Err.	0.38	0.34	0.31	0.20	0.11	n/a	0.49
count	5	10	5	10	10	n/a	10

Table 6-2g. Poptools stock-recruitment curve fit parameter estimates. Boxed values were used in the current productivity calculation (Beverton-Holt and Ricker were taken at 20% of equilibrium).

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.14	0.36	n/a	n/a	0.17	0.91	34.2	1.31	0.25	n/a	n/a	0.18	0.72	24.1
Const. Rec	1501	492	n/a	n/a	n/a	n/a	34.8	1717	349	n/a	n/a	n/a	n/a	25.3
Bev-Holt	1.72	2.04	4707	10876	0.14	0.93	38.3	$\boxed{2.20}$	1.63	4444	4886	0.16	0.73	27.6
Hock-Stk	1.59	0.79	1036	664	0.13	0.93	38.3	$\boxed{1.31}$	0.14	8300	0	0.18	0.72	28.3
Ricker	1.68	1.57	0.00027	0.00062	0.13	0.93	38.3	$\boxed{2.10}$	1.11	0.00033	0.00035	0.15	0.74	27.5

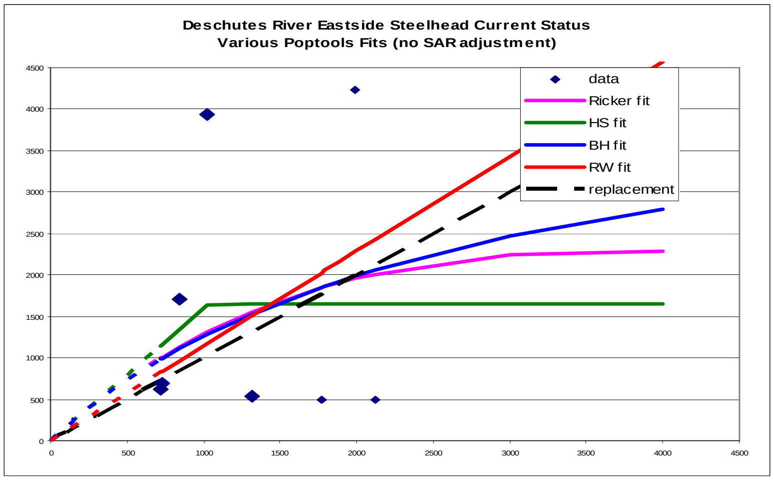


Figure 6-2h. Stock-recruitment curves for the Deschutes River Eastside population. Data not adjusted for marine survival.

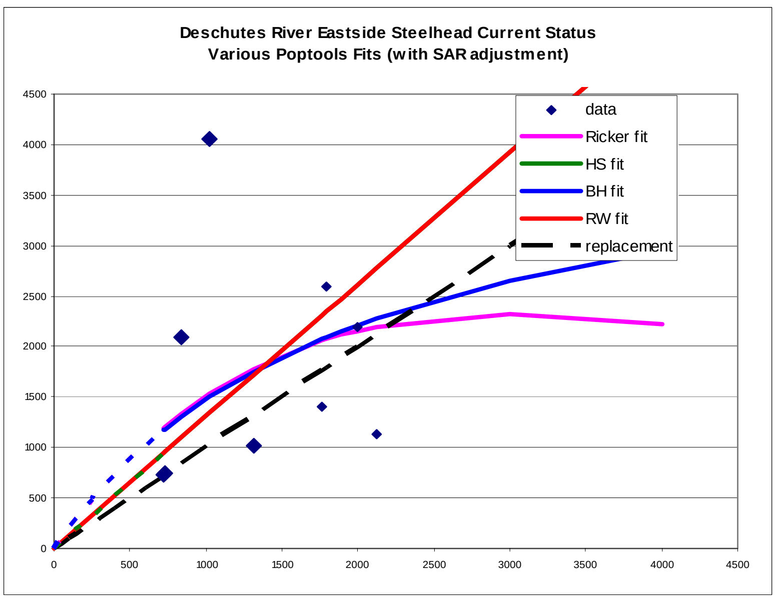


Figure 6-2i. Stock-recruitment curves for the Deschutes River Eastside population. Data adjusted for marine survival.

6.1.3 Deschutes River Westside Steelhead Population

The Deschutes River Westside steelhead population (Figure 6-3a) is part of the Mid-Columbia Steelhead ESU which has four major population groupings, including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers and the Yakima River group. There are three life history categories in the ESU including: summer run, winter run, and summer-winter run combination. The Deschutes Westside population is a summer run and resides in the Cascades Eastern Slope Tributaries MPG.

The size category for the Deschutes Westside population can be classified as either “Large” or “Intermediate” depending on whether the classification is based on historically accessible habitat or currently accessible habitat. These size category options exist because access to a considerable amount of habitat is blocked by Pelton Re-regulation Dam within the population, with current spawning only below the barrier (Table 6-3a). A steelhead population classified as large has a mean minimum abundance threshold of 1,500 natural spawners with sufficient intrinsic productivity (greater than 1.35 recruits per spawner at the threshold abundance level) to achieve a 5% or less risk of extinction over a 100-year timeframe. Alternatively, a steelhead population classified as intermediate has a mean minimum abundance threshold of 1,000 natural spawners, and sufficient intrinsic productivity (greater than 1.4 recruits per spawner at the threshold abundance level) to achieve a 5% risk of extinction over 100 years. In this assessment we evaluate the population with the Abundance/Productivity and Spatial Structure/Diversity criteria for an Intermediate sized population that can assess only the habitat below Pelton Re-regulation Dam. Viable status for this population could not be achieved using criteria for a large population because current capacity is not adequate to meet abundance criteria and spatial distribution is considerably impaired due to loss of access to production areas above Pelton Re-Regulation Dam.

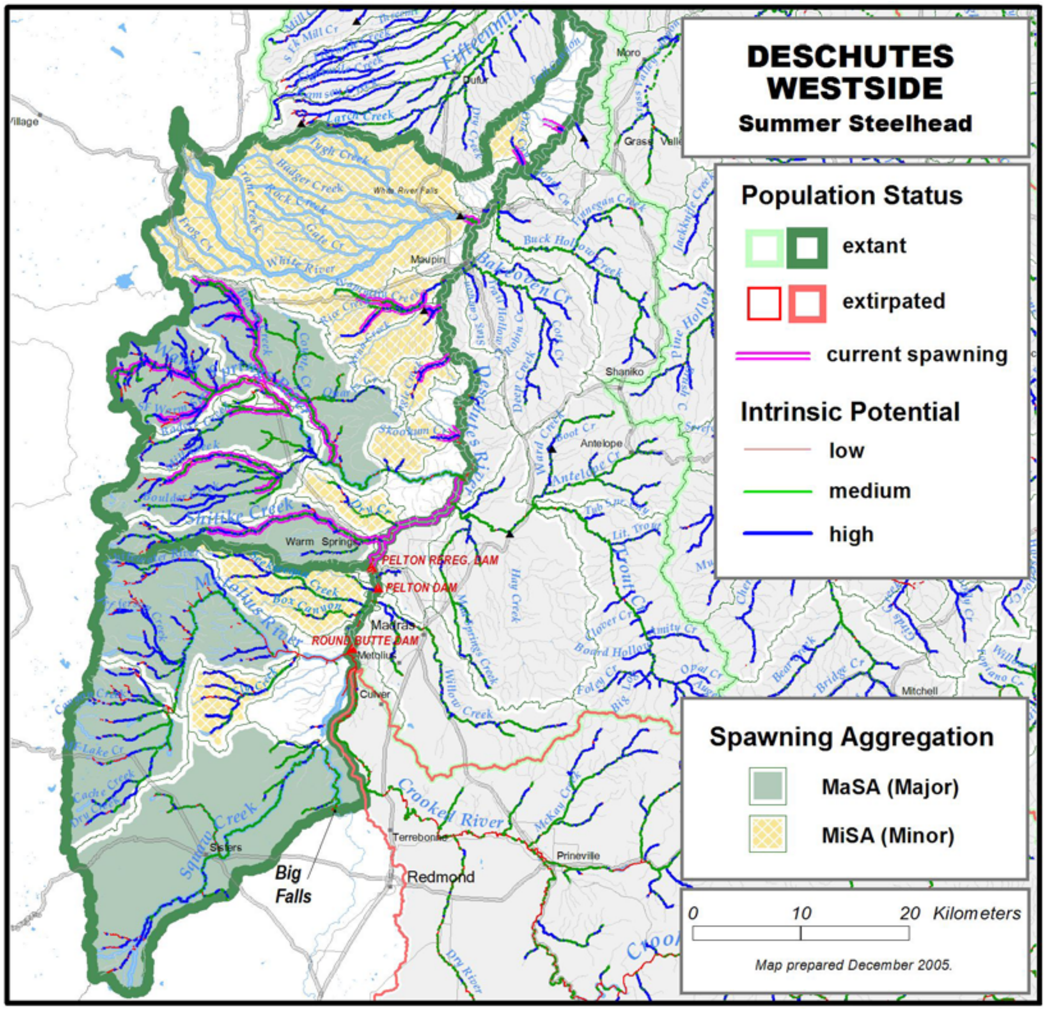


Figure 6-3a. Deschutes River Westside Steelhead population boundaries and major and minor spawning areas—historically accessible population areas

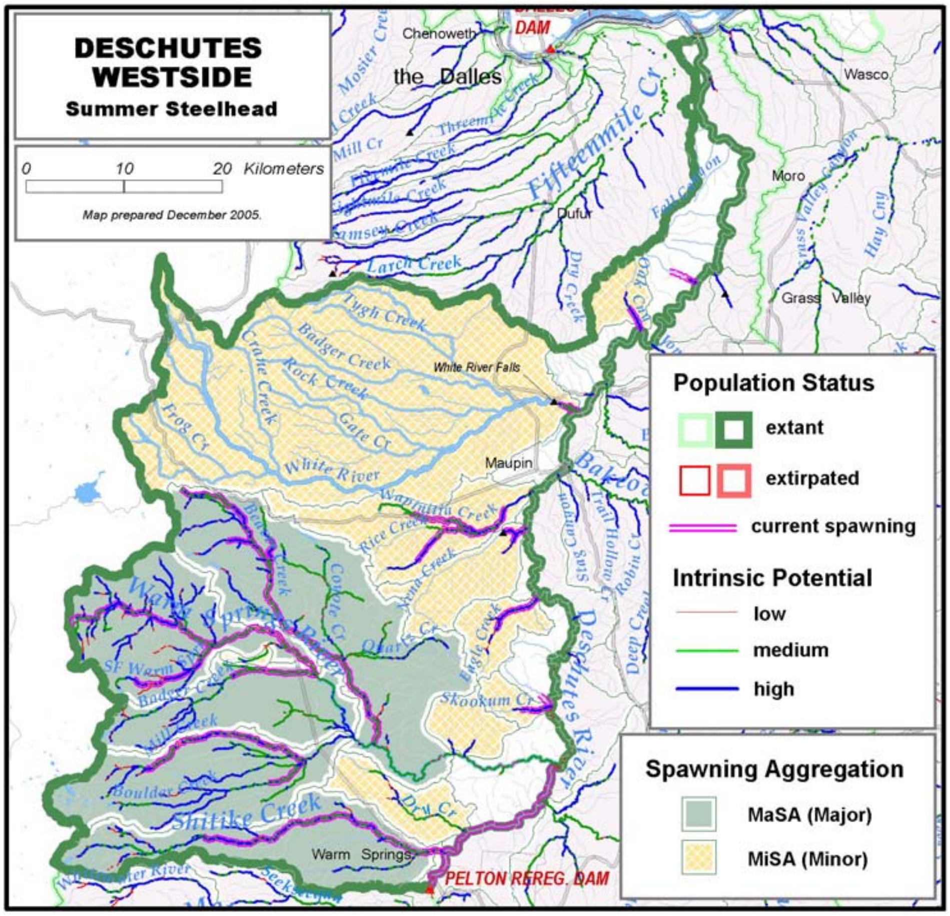


Figure 6-3b. Deschutes River Westside Steelhead population boundaries and major and minor spawning areas—currently accessible areas only

Table 6-3a. Deschutes River Westside Steelhead basin statistics

Metric	All areas	Currently Accessible areas
Drainage Area (km2)	6,060	3,619
Stream lengths km* (total)	2,230	1,511
Stream lengths km* (below natural barriers)	1,474	937
Branched stream area weighted by intrinsic potential (km2)	5.51	2.98
Branched stream area km2 (weighted and temp. limited)	5.11	2.65
Total stream area weighted by intrinsic potential (km2)	7.07	3.67
Total stream area weighted by intrinsic potential (km2) temp limited	6.35	3.06
Size / Complexity category	Large / B (dendritic)	Intermediate / B
Number of MaSAs	8	5
Number of MiSAs	11	9

*All stream segments greater than or equal to 3.8m bankfull width were included

**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C.

Current Abundance and Productivity

Current (1978 to 2005) abundance (number of adult spawners in natural production areas) has ranged from 157 (1996) to 1,605 (2003) (Figure 6-3c). Abundance estimates for the Deschutes Westside population of adult spawning steelhead are the sum of abundance estimates for three components of the population:

1. wild fish upstream of the Warm Springs NFH barrier dam at RKM 16 in the Warm Springs River;
2. wild and hatchery fish that ascend Shitike Creek; and,
3. wild and hatchery fish that remain in the mainstem Deschutes River and spawn from above the mouth of Trout Creek upstream to Pelton Re-regulation Dam.

The data series begins in the 1978 spawning year with census counts at Warm Springs NFH and the 1982 spawning year with single pass spawning ground surveys in index survey units in Shitike Creek that cover 60% of the currently used spawning habitat. For the mainstem, single pass aerial surveys were conducted in 1995 and 2001 (Pribyl 1995 and 2001), and multiple pass surveys were conducted in 1996 and 1997 (Zimmerman and Reeves 2000).

To estimate spawning abundance in Shitike Creek, observed redd densities (redds/m^2) in surveyed reaches were used to estimate redd densities in unsurveyed areas. Variability in habitat quality and capacity throughout reaches in Shitike Creek is accounted for by using the ICTRT's historical intrinsic potential. The ICTRT intrinsic potential analyses was used to estimate redds per weighted m^2 of habitat in surveyed reaches. To estimate total redds in the population we multiplied the redds per weighted m^2 in surveyed reaches by the total weighted m^2 of currently occupied habitat in Shitike Creek (ICTRT 2005). Historical intrinsic potential is estimated using a simple GIS-based model that accounts for differences across stream reaches in terms of stream width, gradient, and valley width that are further weighted by habitat quality. A 2.1 fish per redd expansion was used to estimate annual spawner abundance (personal communication, R. Carmichael, ODFW, La Grande). This estimate was derived for summer steelhead in Deer Creek, a tributary of the Wallowa River. For the 1978-1981 spawning years when spawning ground surveys were not conducted in Shitike Creek, the Shitike Creek abundance was assumed to represent 1.6% of the Sherars Falls escapement based on the average proportional relation between Shitike Creek and Sherars Falls escapement from 1982 to present.

Abundance estimates for the mainstem Deschutes River upstream of Trout Creek also assume 2.1 fish per redd. For years when spawning ground surveys were not conducted in the mainstem, an average relative proportion of observed spawning activity per number of fish escaping above Sherars Falls was applied to the Sherars Falls escapement (1.2%).

Abundance of progeny by spawning year is estimated by apportioning the total spawning abundance estimate into hatchery- and wild-origin fish. The proportion of hatchery fish entering Shitike Creek to spawn and hatchery fish remaining in the mainstem upstream of Trout Creek is assumed to be identical to the proportion of hatchery fish observed at the Warms Springs NFH barrier.

Virtually no spawning steelhead in the Deschutes Westside population have been sampled for age at return and no population specific information exists to assign natural origin spawning fish into cohorts to estimate abundance of progeny (Anonymous 2004). Age structure information used to estimate progeny by brood year is based o the average of a two-year sample of scales from wild adult steelhead (N=100) collected in the lower Deschutes River (Olsen, et al., 1991).

Recent year natural spawners include returns originating from naturally spawning parents, strays from the Deschutes Subbasin Round Butte Hatchery program, and a significant number of out-of-ESU hatchery strays from the Snake River. Natural origin spawners have comprised an average of 82% of natural spawning fish since 1978. The percentage of natural origin spawners has ranged from 56% to 99%.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 470 (Table 6-3b). During the period 1980-1999, returns per spawner for steelhead in the Deschutes River Westside population ranged from 0.31 (1987) to 3.77 (1996). The most recent 20-year (1979-1998) geometric mean of returns per spawner SAR adjusted and median delimited was 1.47 (Table 6-3b).

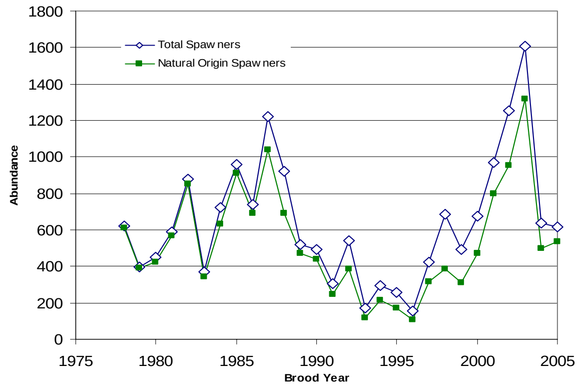


Figure 6-3c. Deschutes River Westside abundance estimates 1978-2005. Estimates based on redd and fish count expansions.

Table 6-3b. Deschutes River Westside abundance and productivity measures.

10-year geomean natural abundance	470
20-year return/spawner productivity	0.91
20-year return/spawner productivity, SAR adj. and delimited* at the median	1.47
20-year Bev-Holt fit productivity, SAR adjusted	n/a
Lambda productivity estimate	1.03
Average proportion natural origin spawners (recent 10 years)	0.74
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds the median. This approach attempts to remove density dependence effects that may influence the productivity estimate.

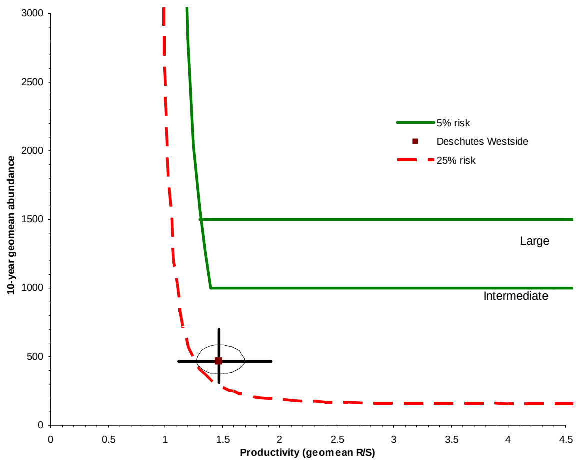


Figure 6-3d. Deschutes River Westside Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Point estimate plotted with a 1SE ellipse, 1.81 X SE productivity line, 1.81 X SE abundance line.

Comparison to the Viability Curve

- Abundance: 10-yr geomean natural origin spawners
- Productivity: 20-yr geomean R/S (adjusted for marine survival and delimited at 505 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Deschutes River Westside population is at **MODERATE RISK** based on current abundance and productivity. The point estimate resides between the 5% and 25% risk curves (Figure 6-3d). The adjusted standard error for productivity extends below the 25% risk curve.

Spatial Structure and Diversity

The ICTRT has identified eight major spawning areas (MaSAs) and eleven minor spawning areas (MiSAs) in the historically accessible habitat within the Deschutes River Westside Steelhead population (Figure 6-3e). In the currently accessible habitat there are five MaSAs and nine MiSAs (Figure 6-3f). Current distribution is reduced significantly from the historic distribution as a result of loss of accessibility to the Metolius River and Squaw Creek drainages. Spawning is currently concentrated in the Warm Springs River and Shitike Creek, as well as in the mainstem Deschutes River between Trout Creek and Pelton Re-regulation Dam.

Spawners within the Deschutes River Westside population include natural origin returns, hatchery returns of Deschutes River origin fish produced from Round Butte Hatchery, and out-of-ESU hatchery strays primarily from the Snake River Basin. Hatchery-origin fish comprise a significant proportion of the natural spawners in Shitike Creek and the Deschutes River mainstem. Hatchery fish are removed from returns to the Warm Springs River at Warm Springs Hatchery, which reduces the proportion of natural spawning hatchery fish in the population.

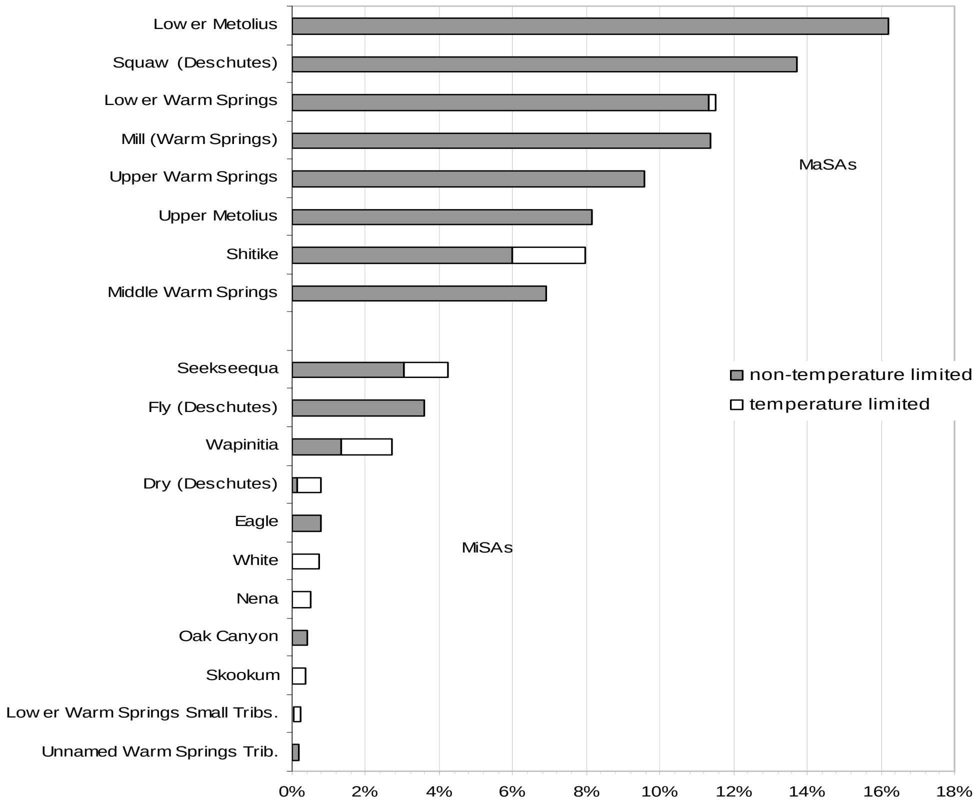


Figure 6-3e. Percentage of historical spawning habitat by major/minor spawning area in the Deschutes River Westside population. This figure is based on historically accessible areas within the population.

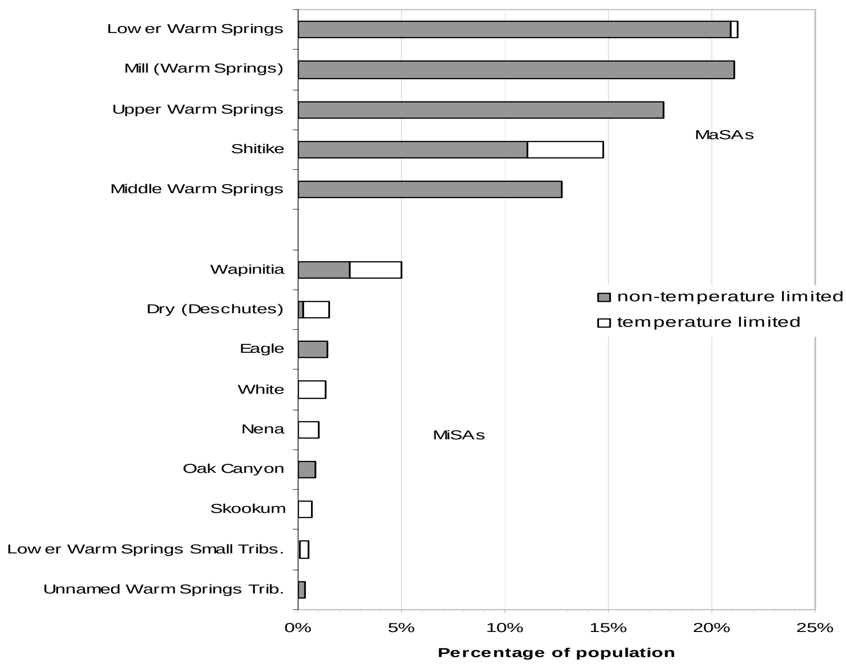


Figure 6-3f. Percentage of historical spawning habitat by major/minor spawning area in currently accessible areas of the Deschutes River Westside population.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.
The Deschutes River Westside population has five MaSAs and nine MiSAs distributed in a dendritic pattern. Within the currently accessible habitat, the historic primary production areas include the Warm Springs River, Shitike Creek, and the Deschutes River mainstem. Based on the ODFW current spawner distribution database, all five of the MaSAs are currently occupied and seven of the MiSAs are occupied. The Deschutes River Westside population is rated at **very low risk** for this metric.

A.l.b. Spatial extent or range of population.

The current spawner distribution is nearly identical to the historic intrinsic distribution for the currently accessible habitat. There appears to be only a small reduction in the extent of spawning with absence of occupancy in two MiSAs, a lower Warm Springs small tributary and a small unnamed Warm Springs tributary (Figures 6-3g and 6-3h). The population is rated at **very low risk** because the current distribution mirrors the historic distribution. There are index spawning surveys conducted in the Warm Springs River drainage and the Shitike Creek drainage. Results of these surveys will be evaluated for future viability assessments.

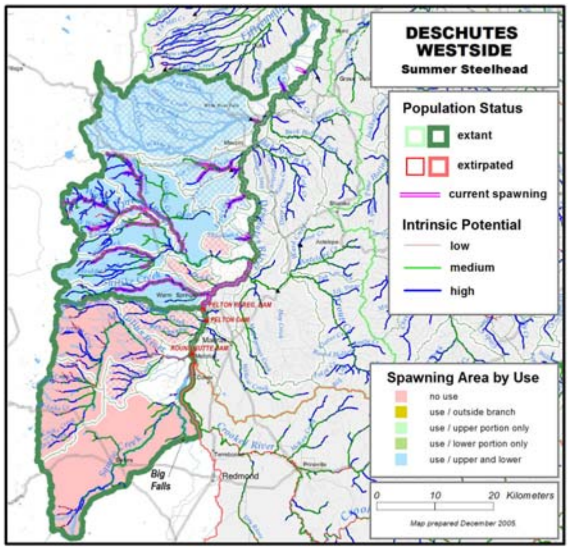
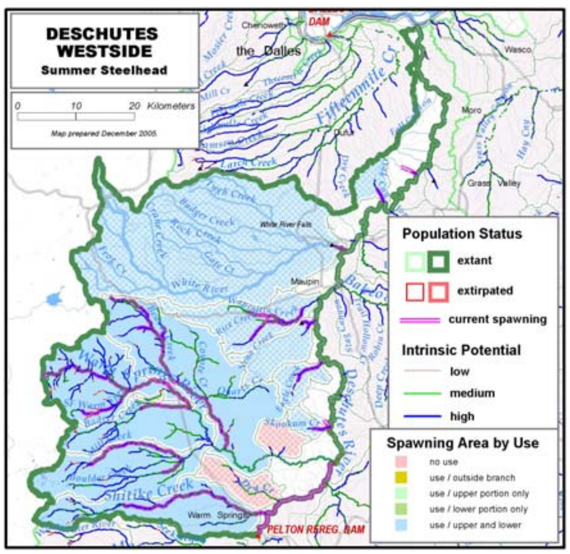


Figure 6-3g. Deschutes River Westside Steelhead distribution—historically accessible population areas.

Figure 6-3h. Deschutes River Westside Steelhead distribution—currently accessible areas only.



A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.

There has been no change in gaps between, or continuity within, the spawning areas in the Deschutes River Westside population. The population is rated at **very low risk** for this metric.

B.1.a. Major life history strategies.

There are limited data to allow any direct comparisons of historic and current major life history strategies. Current habitat conditions are such that the potential for diverse juvenile life history patterns, such as movement between tributary and mainstem, as well as tributary and mainstem rearing, are possible. The population demonstrates multiple ages of smolt migration and ocean residence time. It does not appear likely that any loss in variability or change in major life history strategies has occurred for this population. Thus, the population rated at **very low risk** for this metric.

B.1.b. Phenotypic variation.
We have no direct observations to assess loss or substantial changes in phenotypic traits, therefore we must infer from habitat conditions. However, there does not appear to be the level of habitat changes within the basin that would result in loss of any major traits or substantial shifts in the mean of multiple traits. It is likely that flow and temperature changes in the mainstem Columbia River, as well as temperature changes within the Deschutes River Subbasin, have influenced adult migration timing as well as smolt migration timing to a small degree. Thus, we have rated the population at **low risk** for this metric.

B.1.c. Genetic variation.
There are only a few samples available from the Deschutes Westside population, and those that are available are from a small tributary, Nena Creek. These samples show similarity to both the Eastside Deschutes population samples and to out-of-population hatchery samples. Primarily on the basis of limited information and apparent similarity to the out-of-population hatchery samples, we have rated the population at **moderate risk** for this metric. Additional tissue samples have been collected and will be analyzed in the near future. The genetics variation metric will be reassessed for this population following the completion of analyses of the recent samples.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. A significant number of out-of-ESU strays spawn naturally in the Deschutes Westside population. Estimates of strays are derived from stray hatchery proportions and stray origin data collected at the Warm Springs National Fish Hatchery trap and expanded to unsampled areas in the population. Hatchery fish are removed at Warm Springs Hatchery, thus the overall hatchery proportion in the population is less than the proportion observed at Warm Springs Hatchery. The majority of stray hatchery fish at Warm Springs are out-of-ESU strays. Since 1978 we estimated that hatchery strays have comprised 18% of the natural spawners in the population. Of the 18%, about 15.2 % were estimated as out-of-ESU strays, primarily from the Snake River Basin. We were unable to acquire stray origin data for the most recent years, thus we will update the risk rating when the data are received. Given the high proportion and the length of time that out-of-ESU hatchery strays have been present in this population, the rating is **very high risk** for this metric.

(2) *Out-of-MPG strays from within the ESU*. There have been few out-of-MPG within ESU strays recovered in the Deschutes River. The only source for this type of stray fish is from the Umatilla Hatchery program. This metric rated at **low risk** due to the low proportion of strays.

(3) *Out-of-population within MPG strays*. There have been no observed strays originating from hatchery programs operated outside the Deschutes Subbasin but within the MPG. The rating is **very low risk**.

(4) *Within-population strays.* The Round Butte Hatchery program operates as a harvest augmentation program within the Deschutes Subbasin and does not use best management practices as described for supplementation programs. Round Butte Hatchery fish are present in the natural spawning population at low levels with the average at 2.8% since 1978. We have

rated the metric at **low risk** because of the low proportion of hatchery fish in the natural spawning population.

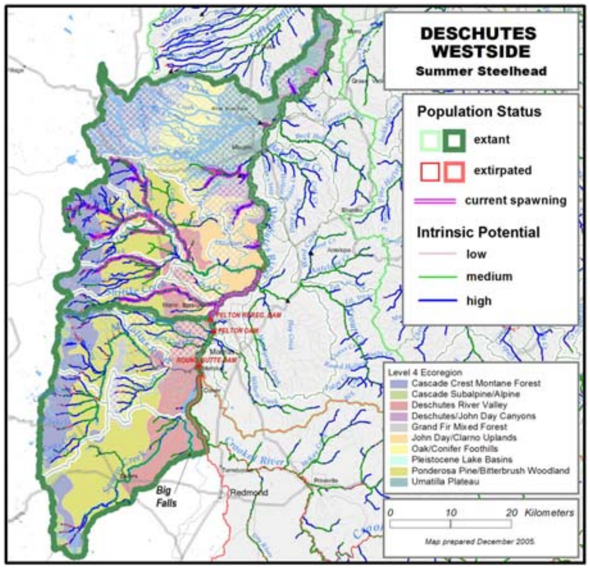


Figure 6-3i. Deschutes River Westside Steelhead population distribution across various ecoregions—historically accessible population areas.

B.3.a. Distribution of population across habitat types.
The intrinsic potential distribution within currently accessible habitat encompassed seven Level 4 ecoregions (Figures 6-3i and 6-3j), of which only three accounted for 10% or more of the distribution (Table 6-3c). There has been no substantial shift in ecoregion distribution from the historic intrinsic to the current distribution (Table 6-3c). The population rated as **low risk** because there are only three ecoregions with no substantial change in proportional distribution.

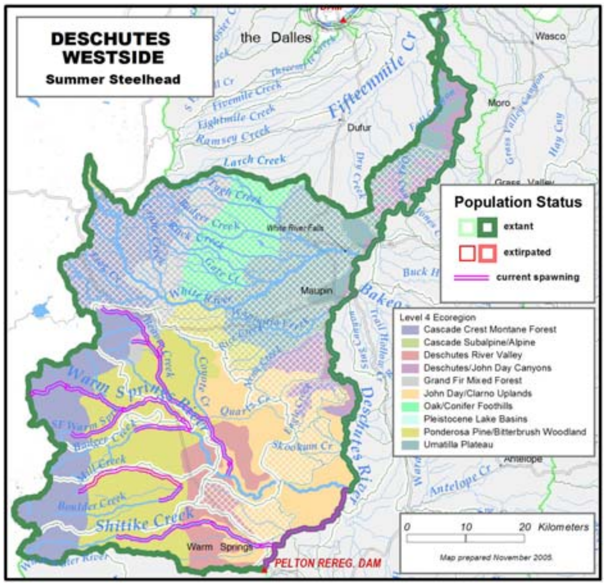


Figure 6-3j. Deschutes River Westside Steelhead population distribution across various ecoregions—currently accessible areas only.

Table 6-3c. Deschutes River Westside Steelhead—proportion of spawning area across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temp. limited)	% of currently occupied spawning area in this ecoregion (non-temp. limited)	% of historical spawning area in this ecoregion (non-temp. limited) currently occupied	% of currently occupied spawning area in this ecoregion (non-temp. limited) currently occupied
Cascade Crest Montane Forest	15.1	10.1	19.4	11.6
Deschutes River Valley	14.3	4.2	9.5	4.8
Deschutes/ John Day Canyons	2.2	7.6	4.1	8.4
Grand Fir Mixed Forest	0.9	2.0	1.5	2.4
John Day/ Clarno Uplands	7.8	13.4	14.4	13.0
Ponderosa Pine/ Bitterbrush Woodland	57.1	53.8	46.5	50.1
Umatilla Plateau	2.5	8.8	4.6	9.6

B.4.a. Selective change in natural processes or selective impacts.
Hydropower system: The hydrosystem and associated reservoirs impose some selective mortality on both juvenile and adults during migration. The magnitude of mortality and the component of the population are unknown. The selective mortality is not likely to remove 25% or more of any component of adult or smolt migration, thus the population rated at **low risk** for this metric.

Harvest: Recent mainstem harvest rates for Group A steelhead have been generally less than 10% of the aggregate annually. Although some harvest may be size selective for larger fish, the selective mortality would not approach the 25% required to reach the moderate risk level. There is no recreational harvest within the subbasin recreational fishery and mortality results only from incidental catch and release. The population rated at **low risk** for this metric.

Hatcheries: Hatchery broodstock are collected at Pelton Dam. Broodstock are collected in a manner that results in no selective mortality for Deschutes Westside natural fish. The population rated at **very low risk** for this metric.

Habitat: Hydrograph and temperature changes within the population have likely imposed some small selective mortality on components of the adult and juvenile life histories. However, these mortality factors are likely small and insignificant, thus the population rated at **very low risk** for this metric.

Spatial Structure and Diversity Summary

The integrated Spatial Structure/Diversity rating is moderate risk for the Deschutes River Westside population (Table 6-3d). The population rates at very low risk for all spatial distribution metrics because the current distribution in accessible areas mirrors the historic intrinsic distribution. Ratings for two metrics related to Goal B "maintaining natural patterns of variation" resulted in a moderate rating for Goal B and the overall moderate rating. Genetic variation rated moderate due to limited data and the lack of differentiation between the Deschutes samples and outside-basin hatchery samples. Samples collected in 2005 will better inform the risk associated with genetic variation. The proportion of out-of-ESU hatchery strays resulted in a high risk rating for spawner composition. Most of these strays originate from the Snake River Basin.

Table 6-3d. Spatial structure and diversity scoring table.

<table>
<tr><th rowspan="2">Metric</th><th colspan="5">Risk Assessment Scores</th></tr>
<tr><th>Metric</th><th>Factor</th><th>Mechanism</th><th>Goal</th><th>Population</th></tr>
<tr><td>A.1.a</td><td>VL (2)</td><td>VL (2)</td><td rowspan="3">Mean=(2.0)
Very Low Risk</td><td rowspan="3">Very Low Risk (2.0)</td><td rowspan="12">Moderate Risk</td></tr>
<tr><td>A.1.b</td><td>VL (2)</td><td>VL (2)</td></tr>
<tr><td>A.1.c</td><td>VL (2)</td><td>VL (2)</td></tr>
<tr><td>B.1.a</td><td>VL (2)</td><td>VL (2)</td><td rowspan="3">Moderate (0)</td><td rowspan="9">Mean=(0.5)
Moderate Risk</td></tr>
<tr><td>B.1.b</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.1.c</td><td>M (0)</td><td>M (0)</td></tr>
<tr><td>B.2.a(1)</td><td>H (-1)</td><td rowspan="4">High Risk
(-1)</td><td rowspan="4">High Risk (-1)</td></tr>
<tr><td>B.2.a(2)</td><td>L (1)</td></tr>
<tr><td>B.2.a(3)</td><td>VL (2)</td></tr>
<tr><td>B.2.a(4)</td><td>M (0)</td></tr>
<tr><td>B.3.a</td><td>L (1)</td><td>L (1)</td><td>VL (2)</td></tr>
<tr><td>B.4.a</td><td>VL (2)</td><td>VL (2)</td><td>L (1)</td></tr>
</table>

Overall Viability Rating

The overall rating for the Deschutes River Westside steelhead population does not currently meet the ICTRT recommended viability criteria (Figure 6-3k) because both the Abundance/Productivity and the Spatial Structure/Diversity risk ratings are moderate risk. The 10-year geometric mean abundance of 410 is well below the minimum threshold of 1,000 required for an Intermediate sized population. The lower end of the adjusted productivity standard error extends well below the 25% risk level. A substantial increase in productivity will be required to raise the productivity value to the low risk level. The genetics information that is presently being collected will better inform the genetics variation risk level in the future. A reduction in the out-of-ESU hatchery stray proportion will be needed to reduce the risk rating for the spawner composition metric.

Spatial Structure/Diversity Risk

Abundance/Productivity Risk		Very Low	Low	Moderate	High
	Very Low (<1%)	HV	HV	V	
	Low (<5%)	V	V	MV	
	Moderate (6-25%)			Deschutes Westside	
	High >(25%)				

Figure 6-3k. Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV= Minimally Viable.

Deschutes River Westside Steelhead – Data Summary

Data type: Redd count expansions
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 6-3e. Deschutes River Westside Steelhead run data (used for curve fits and R/S analysis). Entries where the spawner number is less than the median escapement (1980-1999) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1980	**450**	**0.94**	**422**	**703**	**1.56**	**0.50**	**355**	**0.79**
1981	592	0.96	569	828	1.40	0.68	566	0.96
1982	879	0.97	852	807	0.92	0.46	369	0.42
1983	**371**	**0.93**	**344**	**876**	**2.36**	**0.52**	**459**	**1.24**
1984	725	0.87	634	633	0.87	0.65	409	0.56
1985	961	0.95	910	465	0.48	0.46	214	0.22
1986	737	0.94	689	377	0.51	0.94	356	0.48
1987	1221	0.85	1038	294	0.24	2.18	640	0.52
1988	920	0.75	692	285	0.31	0.99	282	0.31
1989	518	0.91	472	167	0.32	0.96	161	0.31
1990	**493**	**0.89**	**439**	**190**	**0.39**	**2.83**	**538**	**1.09**
1991	**307**	**0.80**	**245**	**166**	**0.54**	**2.33**	**387**	**1.26**
1992	540	0.72	387	192	0.35	1.88	360	0.67
1993	**169**	**0.69**	**117**	**324**	**1.91**	**1.18**	**383**	**2.26**
1994	**297**	**0.72**	**213**	**367**	**1.23**	**1.07**	**393**	**1.32**
1995	**257**	**0.68**	**173**	**396**	**1.54**	**1.23**	**486**	**1.89**
1996	**157**	**0.69**	**109**	**592**	**3.77**	**1.03**	**611**	**3.89**
1997	**424**	**0.75**	**317**	**844**	**1.99**	**0.76**	**644**	**1.52**
1998	687	0.56	384	1025	1.49	0.49	503	0.73
1999	**493**	**0.63**	**312**	**994**	**2.02**	**0.52**	**514**	**1.04**
2000	676	0.70	474					
2001	970	0.82	796					
2002	1252	0.76	955					
2003	1605	0.82	1317					
2004	637	0.78	498					
2005	617	0.87	535					

Table 6-3f. Geomean abundance and productivity estimates. Current abundance and productivity values are boxed

	R/S measures						Lambda measures		Abundance
	Not adjusted			SAR adjusted			Not adjusted		Nat. origin
delimited	median	75% lg thresh	75% int thresh	median	75% lg thresh	75% int thresh	1988-1999	1980-1999	geomean
Point Est.	1.46	0.78	1.10	1.47	0.86	1.04	1.04	1.03	470
Std. Err.	0.22	0.18	0.19	0.14	0.17	0.16	0.11	0.12	0.22
count	10	19	16	10	19	16	12	20	10

Table 6-3g. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.91	0.16	n/a	n/a	0.34	0.67	52.0	0.84	0.13	n/a	n/a	0.38	0.49	47.6
Const. Rec	445	60	n/a	n/a	n/a	n/a	41.3	409	32	n/a	n/a	n/a	n/a	19.0
Bev-Holt	15.91	57.44	477	136	0.07	0.90	44.0	50	78	417	35	0.12	0.12	22.1
Hock-Stk	3.01	9.97	148	491	0.07	0.91	44.0	2.73	11.07	150	609	0.12	0.11	21.8
Ricker	2.55	0.78	0.00184	0.00049	0.12	0.82	44.1	2.72	0.55	0.00211	0.00033	0.16	0.03	27.8

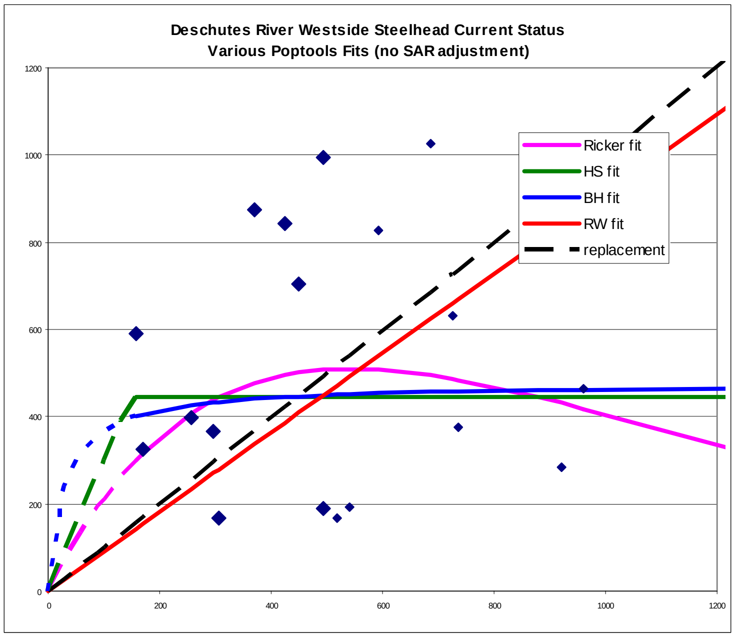
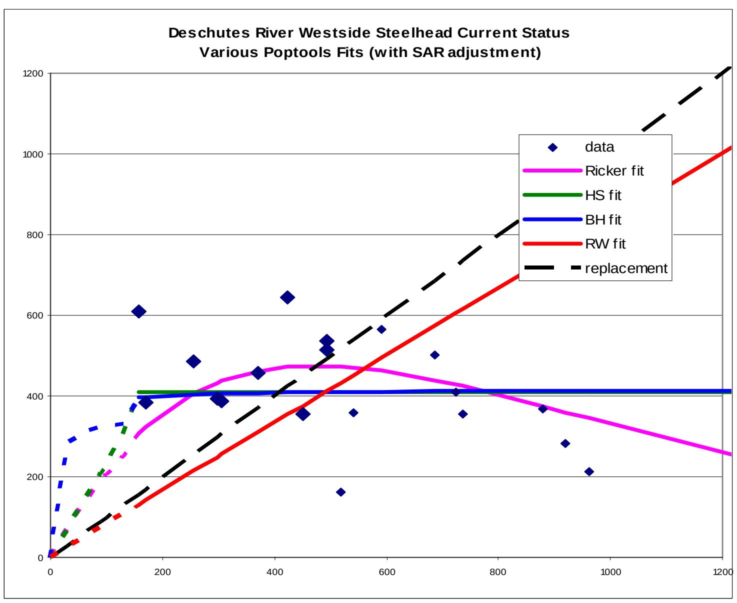


Figure 6-3l. Stock-recruitment curves for the Deschutes River Westside population. Data not adjusted for marine survival.

Figure 6-3m. Stock-recruitment curves for the Deschutes River Westside population. Data adjusted for marine survival.



6.1.4 Lower John Day River Mainstem Tributaries Steelhead Population

The Lower John Day River Mainstem Tributaries steelhead population (Figure 6-4a) is part of the Mid-Columbia steelhead ESU which has four major population groupings (MPG), including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla rivers, and the Yakima River group. The ESU contains three major life history categories: summer run, winter run, and summer-winter run combination. The Lower John Day population is a summer run and resides in the John Day River MPG.

The ICTRT classified the Lower John Day population as a "very large" population (Table 6-4a) based on historical habitat potential (ICTRT 2005). A steelhead population classified as very large has a minimum abundance threshold criteria of 2,250 naturally produced spawners with sufficient intrinsic productivity (greater than 1.25 recruits per spawner at the threshold abundance level) to achieve a 5% or less risk of extinction over a 100-year timeframe.

Figure 6-4a. Lower John Day River Steelhead population boundaries and major and minor spawning areas.

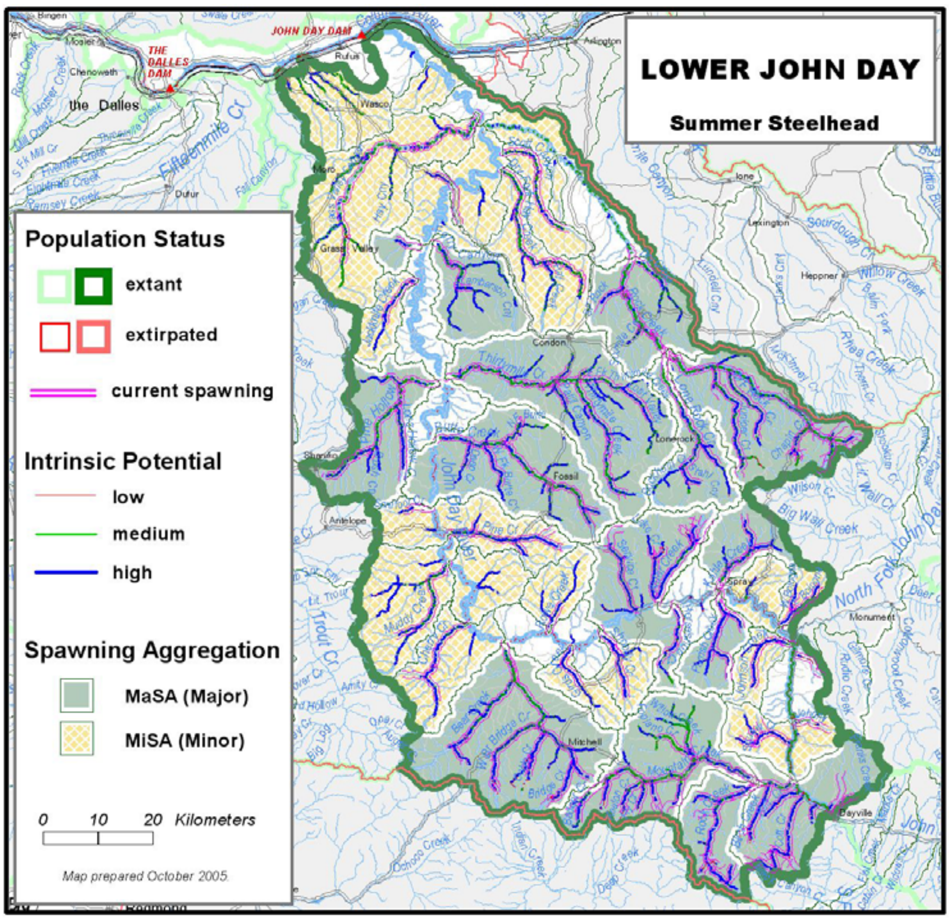


Table 6-4a. Lower John Day River Steelhead basin statistics

Drainage Area (km2)	9,857
Stream lengths km* (total)	2,455
Stream lengths km* (below natural barriers)	2,411
Branched stream area weighted by intrinsic potential (km2)	7.53
Branched stream area km2 (weighted and temp. limited)	5.92
Total stream area weighted by intrinsic potential (km2)	9.546
Total stream area weighted by intrinsic potential (km2) temp limited	6.816
Size / Complexity category	Very Large / B (dendritic structure)
Number of MaSAs	13
Number of MiSAs	22

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22ºC.

Current Abundance and Productivity

Current (1965 to 2005) abundance (number of adult spawners in natural production areas) for this population has ranged from 111 (1979) to 10,557 (1987) (Figure 6-4b). Abundance estimates are based on expanded redd counts. ODFW, John Day district, index surveys of steelhead redds were used for the historical data set. We used index surveys that showed relatively consistent visitation through years. Survey data from Bear, Kahler, Parrish, Pine, and Thirtymile creeks were used in the analyses. The current spawning distribution was used for the miles of available habitat within each population’s range. The index redd densities were then multiplied by a correction factor to estimate the annual redd densities for the entire spawning distribution, based on the ratio of index redd densities to EMAP redd densities for 2004-05. This ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (.355x index density) was multiplied by the total miles of spawning habitat currently utilized. Total annual redds were converted to fish by multiplying total annual redds by fish per redd. Fish per redd ratios were developed from survey data on Deer Creek in the Grande Ronde Basin. The ratio is an average from four years of data of complete and repeated surveys (census) of redds above a weir where we have a complete fish count. The average fish per redd estimate from Deer Creek was 2.1.

The hatchery/wild composition of spawners was computed for the Lower Mainstem separately, and combined for all other populations. Data included observations of positively identified adipose fin-clipped spawners (1992-present) from spawning surveys. There is evidence from the Deschutes River that hatchery straying was substantially lower before 1992, and because the source of strays in the John Day Basin is the same as the Deschutes we assumed a similar trend. No other data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled fish collected during the 1980s. All samples were unmarked fish from locations above Tumwater Falls.

Recent year natural spawners include returns originating from naturally spawning parents, and a small fraction of strays from the Snake River and Columbia River hatchery programs.

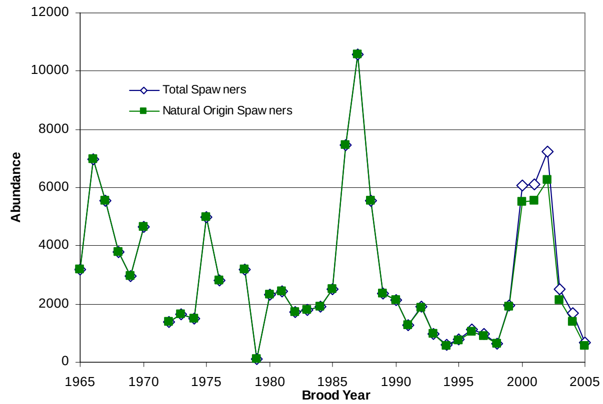


Figure 6-4b. Lower John Day Mainstem Steelhead abundance estimates 1965-2005. Estimates based on expanded redd counts.

Spawners originating from naturally spawning parents have comprised an average of 92%, since hatchery strays were documented in 1992. Since that time, the percentage of natural spawners has ranged from 82% to 99%.Abundance in recent years has been highly variable, the most recent 10-year geomean number of natural origin spawners was 1800 (Table 6-4b). During the period 1975-1997, returns per spawner for steelhead in the John Day lower mainstem tributaries population ranged from 0.14 (1987) to 17.5 (1979). The most recent
19-year (1980-1998) SAR adjusted and median delimited geometric mean of returns per spawner was 2.59 (Table 6-4b).

Table 6-4b. Lower John Day Mainstem Steelhead abundance and productivity measures.

10-year geomean natural abundance	1800
19-year return/spawner productivity	1.24
19-year return/spawner productivity, SAR adj. and delimited* at the median	2.59
19-year Bev-Holt fit productivity, SAR adjusted	n/a
19-year Lambda productivity estimate	1.02
Average proportion natural origin spawners (recent 10 years)	0.9
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds the median. This approach attempts to remove density dependence effects that may influence the productivity estimate.

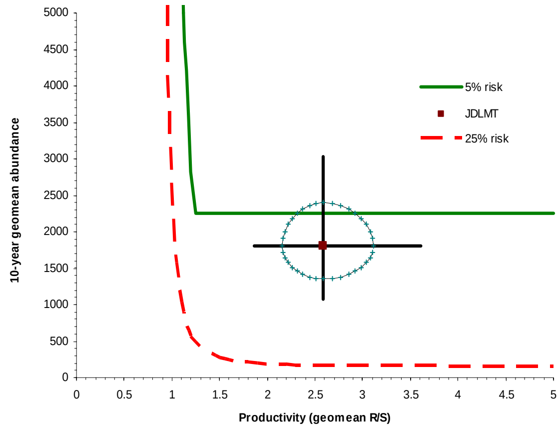


Figure 6-4c. Lower John Day Mainstem Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Plot shows a 1 SE ellipse, 1.81 X SE abundance line, and 1.81 X SE productivity line.

Comparison to the Viability Curve

- Abundance: 10-yr geomean natural origin spawners
- Productivity: 19-yr geomean R/S (adjusted for marine survival and delimited at 1,916 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Lower John Day River population is at MODERATE risk based on current abundance and productivity. The productivity is very low risk because the point estimate is above very low risk and the lower end of the adjusted standard error is above the 5% risk level. The abundance is moderate risk because it resides between the 5% and 25% risk levels (Figure 6-4c).

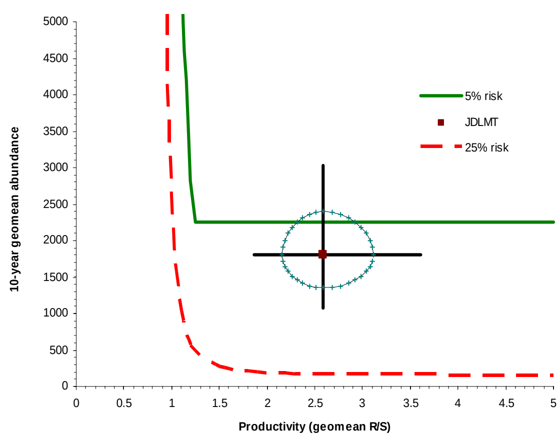


Figure 6-4c. Lower John Day Mainstem Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Plot shows a 1 SE ellipse, 1.81 X SE abundance line, and 1.81 X SE productivity line.

Spatial Structure and Diversity

The ICTRT has identified 13 major spawning areas (MaSAs) and 22 minor spawning areas (MiSAs) within the Lower John Day Mainstem Tributaries population (Figure 6-4d). Spawning is distributed broadly across the landscape in numerous watersheds that flow into the lower mainstem of the John Day River. Moderately large drainages such as Rock Creek, Thirtymile, Bridge, Service, Mountain and Butte comprise a substantial proportion of the production area. In addition, multiple smaller drainages support production. Spawners within the Lower Mainstem Tributaries population are predominantly natural origin; however, outside ESU hatchery fish, primarily from Snake River stocks, are present in significant proportions in some years.

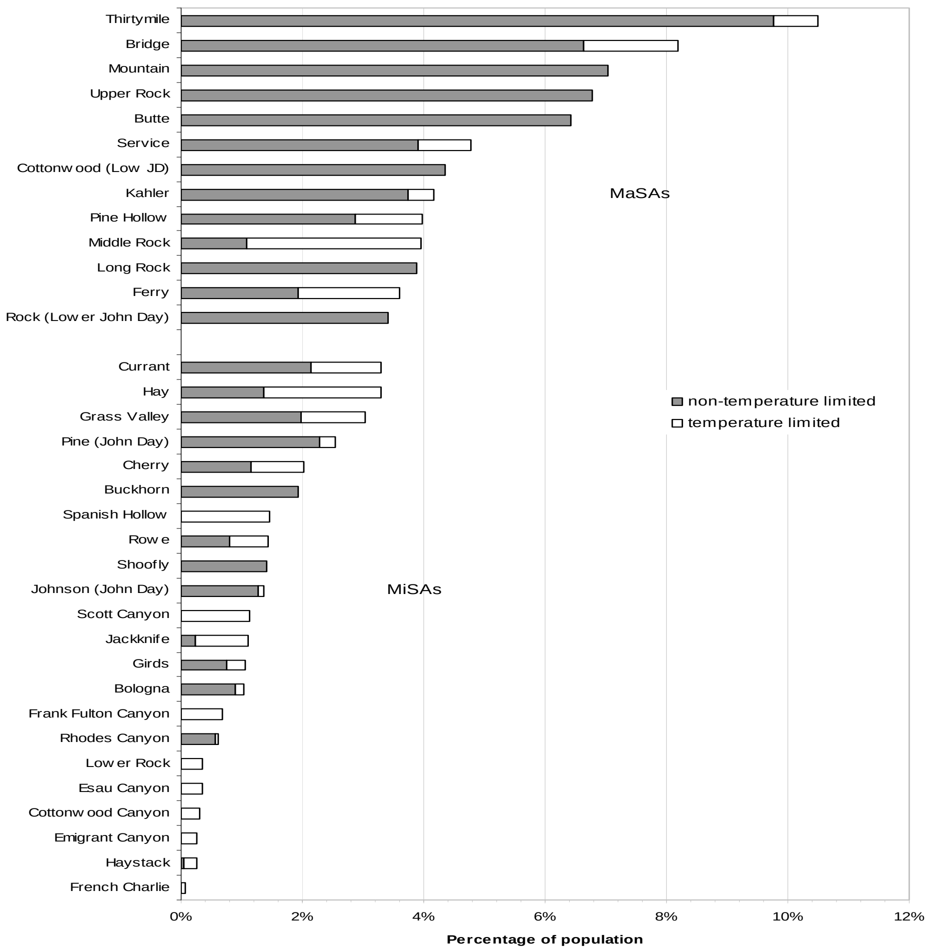


Figure 6-4d. Percentage of historical spawning habitat by major/minor spawning area in the Lower John Day. Temperature limited portions of each MiSA/MaSA are shown in white.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.
The Lower Mainstem tributary population has 13 MaSAs and 22 MiSAs distributed in a very complex dendritic pattern. Intrinsic potential is distributed relatively evenly across the 13 MaSAs. Based on the ODFW spawner distribution database all 13 of the MaSAs are currently occupied and nine of the 22 MiSAs are occupied (Figure 6-4e). A total of 1,197 km of habitat is presently used for spawning. The Lower Mainstem Tributary population is at **very low risk** for number and spatial arrangement of spawning areas.

A.l.b. Spatial extent or range of population.
The current spawner distribution closely resembles the intrinsic potential distribution. All 13 of the MaSAs are currently occupied and nine of the 22 MiSAs are also occupied. The unoccupied MiSAs are scattered throughout the population, and therefore do not result in change in extent and range of distribution. The rating is **very low risk**. There are six index spawning survey sites in the Lower Mainstem Tributaries population. Recent spawning ground survey results will be analyzed for future viability assessment updates.

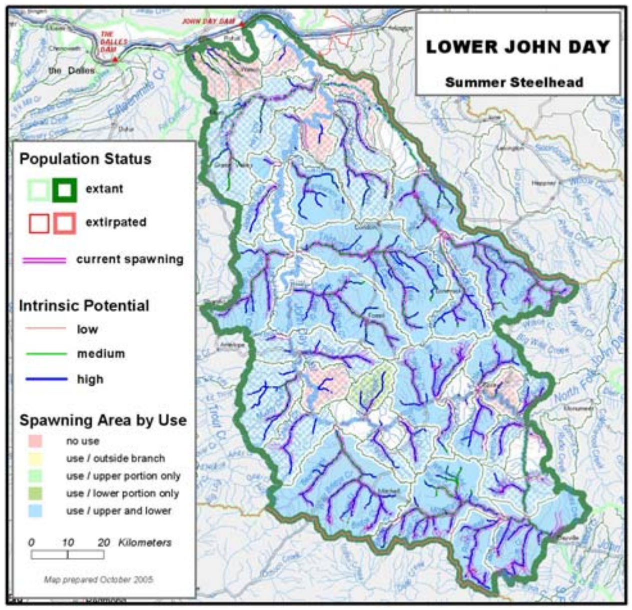


Figure 6-4e. Lower John Day River Steelhead current distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.
There has not been any significant increase in gaps relative to historic intrinsic distribution. Although all MiSAs are not occupied, the remaining 13 MaSAs and nine MiSAs provide good continuity between spawning areas throughout the population as well as relatively unchanged gaps. The Lower Mainstem Tributaries population rating is **very low risk** for this metric.

B.1.a. Major life history strategies
There is limited data available to evaluate changes in life history patterns for this population, thus we must infer based on habitat changes. This population is very large and inhabits a broad geographic area with habitat quality ranging from good to poor. Habitat changes, particularly temperature, have likely reduced movement patterns and summer rearing distribution. Although,

current habitat conditions provide for opportunity for expression of diverse life history strategies. The Lower Mainstem Tributaries population is a Type-A, and based on ages of wild angler caught fish they migrate to the ocean at multiple ages, and adults return after one or two years in the ocean. These life history patterns are consistent with other Type-A steelhead. This population rates at **moderate risk** for this metric because of the loss of tributary habitat rearing due to flow and temperature.

B.1.b. Phenotypic variation.
No data exist to directly assess if any phenotypic traits have been substantially changed or lost, thus we infer from habitat data. We hypothesize that there has been some reduction in variability of traits, such as adult entry and migration timing through the Columbia and John Day rivers, as well as juvenile migration timing. Although the distribution of these types of traits has likely been altered, the magnitude has likely not been substantial. Habitat conditions and absence of significant major phenotypic selective pressures indicate this population is at **low risk** for this metric.

B.1.c. Genetic variation.
There are limited genetics data for John Day populations and no samples have been analyzed for the Lower Mainstem Tributaries population. The major concern regarding genetic variation within the Lower Mainstem Tributaries population relates to the spawner composition and potential genetic affects of out-of-ESU hatchery strays. There are no past population bottlenecks or intentional hatchery practices that would influence genetic variation. Given the high proportion of hatchery strays and that there are no genetics data for this population we have rated this metric as **moderate risk**. We collected samples in 2005 to provide an assessment of the genetic characteristics and variation of the Lower Mainstem Tributaries population. These genetics data will allow for a more informed assessment of the genetic variation in the future.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. The proportion of out-of-ESU hatchery spawners in the Lower Mainstem Tributaries population has ranged from 0.1 in the early 1990's to a high of 0.18 in 2004, with a mean of 0.07. The trend from the early 1990's to 2005 has shown a consistent increase in hatchery proportion through time. Based on CWT recoveries, primarily from recreational fisheries, the hatchery fish originate primarily from the Snake River Basin. Given the high hatchery fraction, the increasing trend through time, and the origin of the strays, this population rates at **high risk** for this metric.

(2) *Out-of-MPG strays from within the ESU*. There have been a total of four coded wire tagged fish recovered in the John Day from out-of-MPG within ESU origin. Three originated from the Umatilla Hatchery program and one from the Deschutes. It appears very few within ESU hatchery fish stray into the John Day, thus the rating is **low risk** for this metric.

(3) *Out of population within MPG strays*. There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk**.

(4) *Within-population hatchery spawners.* There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk.**

B.3.a. Distribution of population across habitat types.

The intrinsic potential distribution of the Lower Mainstem Tributaries population encompassed seven Level 4 ecoregions (Figure 6-4f), although only four had values greater than 10%. There has been little change in ecoregion distribution and no substantial reductions. All ecoregions that had significant use historically remain in use currently (Table 6-4c). The rating is **very low risk** for this metric.

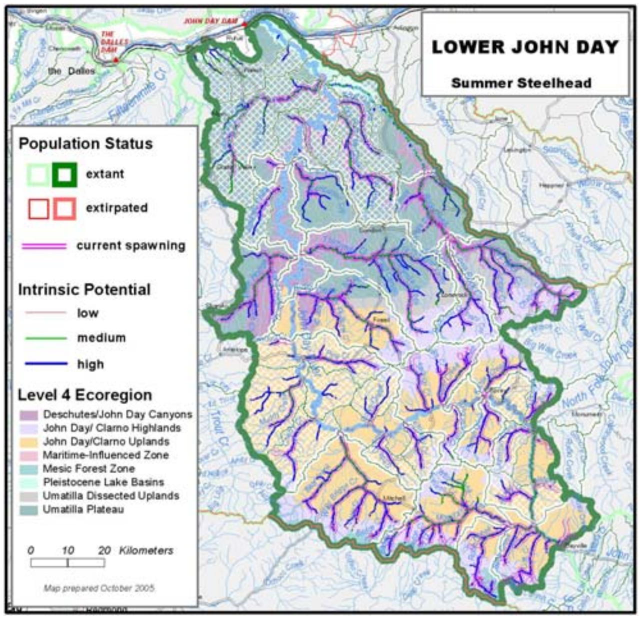


Figure 6-4f. Lower John Day River Steelhead population distribution across various ecoregions.

Table 6-4c. Lower John Day Mainstem Tributaries Steelhead – proportion of spawning area across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Deschutes/John Day Canyons	25.9	29.7
John Day Clarno Highlands	11.2	11.7
John Day Clarno Uplands	44.0	46.4
Mesic Forest Zone	0.6	0.7
Pleistocene Lake Basins	1.9	0.0
Umatilla Dissected Uplands	4.4	4.6
Umatilla Plateau	12.0	6.8

B.4.a. Selective change in natural processes or selective impacts.
Hydropower system: Although the hydrosystem and associated reservoirs likely pose some selective mortality on smolt outmigrants and adult migrants, the mortality would not appear to remove more than 25% of affected individuals. The likely impacts are rated as **low risk**.

Harvest: Recent harvest rates for group A steelhead are generally less than 10% annually. Although some harvest may be size selective for larger fish the selective mortality would not approach 25% of the larger fish, therefore the rating is **low risk** for this metric.

Hatcheries: No hatcheries are operated within this population. The rating is **very low risk** for this metric.

Habitat: Low flows and elevated water temperatures have reduced the opportunity for juveniles to move from early rearing areas in the tributaries into the lower mainstem John Day in early fall. However, within basin habitat changes which would pose selective mortality on adult or juvenile life stages do not appear to be significant enough to raise the risk level to moderate. The rating is **low risk** for this metric.

Spatial Structure and Diversity Summary

The integrated Spatial Structure/Diversity rating is **moderate risk** for the Lower John Day River Mainstem Tributaries population (Table 6-4d). The rating for Goal A "allowing natural rates and level of spatially mediated processes" was very low. The current spawner distribution is similar to historic with all MaSAs occupied. The MiSAs that are currently unoccupied have little influence on gaps and continuity, and spawners are spread over a very broad geographic area.

The rating for Goal B "maintaining natural levels of variation" was moderate risk. This rating was a result of moderate risk for life history and genetic variation and high risk for spawner composition out-of-ESU hatchery strays. The magnitude and trend in out-of-ESU hatchery strays are of significant concern. Analysis of genetics information will yield considerable insight into the genetic variation and characteristics of this population. Examining genetics data for evidence of hatchery introgression will be useful for future spatial structure/diversity risk assessments.

Table 6-4d. Spatial structure and diversity scoring table.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Mean=(2.0) Very Low Risk	Very Low Risk (2.0)	**Moderate Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	VL (2)	VL (2)			
B.1.a	M (0)	M (0)	Moderate (0)	Moderate Risk (0)	
B.1.b	L (1)	L (1)			
B.1.c	M (0)	M (0)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	L (1)				
B.2.a(3)	VL (2)				
B.2.a(4)	VL (2)				
B.3.a	VL (2)	VL (2)	VL (2)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

With a moderate rating for Abundance/Productivity and a moderate rating for Spatial Structure/Diversity, the Lower John Day Mainstem Tributaries population does not currently achieve an overall rating of viable according to ICTRT recommended criteria (Figure 6-4g). Productivity is at a low risk level while abundance is moderate risk. To achieve a viable rating, this population must improve in both Abundance/Productivity and Spatial Structure/Diversity. Out-of-ESU origin spawners are the most influential factor on Diversity Risk. Additional population specific data is needed to better quantify the spawner composition in this population to reduce the uncertainty associated with this risk metric.

Spatial Structure/Diversity Risk

Abundance/ Productivity Risk	Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	
Low (<5%)	V	V	MV	
Moderate (6-25%)			LJDMT	
High >(25%)				

Figure 6-4g. Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV= Minimally Viable.

Lower John Day Steelhead – Data Summary

Data type: Redd count expansions
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 6-4e. Lower John Day Steelhead run data (used for curve fits and R/S analysis). Entries where the spawner number is less than the median escapement (1980-1998) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	adj R/S
1980	2329	1.00	2329	2749	1.18	0.50	1388	0.60
1981	2420	1.00	2420	5525	2.28	0.68	3773	1.56
1982	**1714**	**1.00**	**1714**	**8654**	**5.05**	**0.46**	**3955**	**2.31**
1983	**1815**	**1.00**	**1815**	**7493**	**4.13**	**0.52**	**3924**	**2.16**
1984	1916	1.00	1916	3776	1.97	0.65	2442	1.27
1985	2521	1.00	2521	2154	0.85	0.46	989	0.39
1986	7468	1.00	7468	1716	0.23	0.94	1618	0.22
1987	10557	1.00	10557	1515	0.14	2.18	3297	0.31
1988	5546	1.00	5546	1348	0.24	0.99	1335	0.24
1989	2366	1.00	2366	774	0.33	0.96	744	0.31
1990	2133	1.00	2133	703	0.33	2.83	1990	0.93
1991	**1264**	**1.00**	**1264**	**898**	**0.71**	**2.33**	**2096**	**1.66**
1992	1917	0.99	1889	945	0.49	1.88	1777	0.93
1993	**986**	**0.99**	**972**	**892**	**0.90**	**1.18**	**1054**	**1.07**
1994	**593**	**0.97**	**577**	**1682**	**2.84**	**1.07**	**1801**	**3.04**
1995	**806**	**0.94**	**755**	**3890**	**4.83**	**1.23**	**4765**	**5.92**
1996	**1115**	**0.93**	**1041**	**5597**	**5.02**	**1.03**	**5776**	**5.18**
1997	**960**	**0.95**	**911**	**5527**	**5.75**	**0.76**	**4218**	**4.39**
1998	**652**	**0.96**	**625**	**3929**	**6.02**	**0.49**	**1926**	**2.95**
1999	1933	0.98	1894					
2000	6058	0.91	5524					
2001	6096	0.91	5553					
2002	7231	0.87	6257					
2003	2512	0.85	2134					
2004	1688	0.82	1380					
2005	671	0.84	563					

Table 6-4f. Geomean abundance and productivity estimates. Current abundance and productivity values are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1980-1998	geomean
Point Est.	3.02	2.85	2.59	2.99	0.97	1.02	1800
Std. Err.	0.25	0.34	0.18	0.24	0.35	0.35	0.29
count	9	7	9	7	12	19	10

Table 6-4g. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.24	0.35	n/a	n/a	0.37	0.87	66.3	1.18	0.28	n/a	n/a	0.34	0.82	59.6
Const. Rec	2325	426	n/a	n/a	n/a	n/a	50.1	2202	287	n/a	n/a	n/a	n/a	37.2
Bev-Holt	50	110	2392	476	0.16	0.86	53.2	50	91	2264	326	0.27	0.42	40.3
Hock-Stk	3.58	0.66	652	1	0.16	0.86	52.9	2.99	1.20	750	317	0.26	0.42	39.8
Ricker	3.08	0.86	0.00035	0.00008	0.29	0.77	55.4	2.52	0.59	0.00030	0.00007	0.42	0.40	48.6

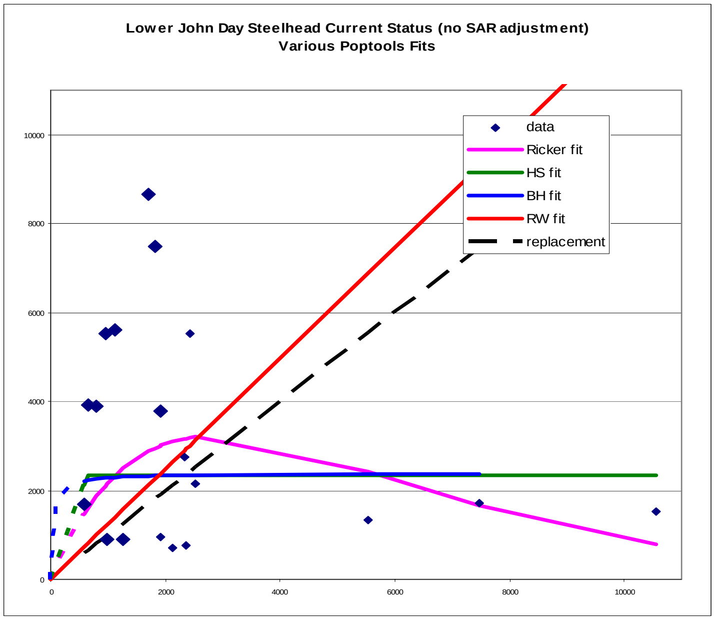
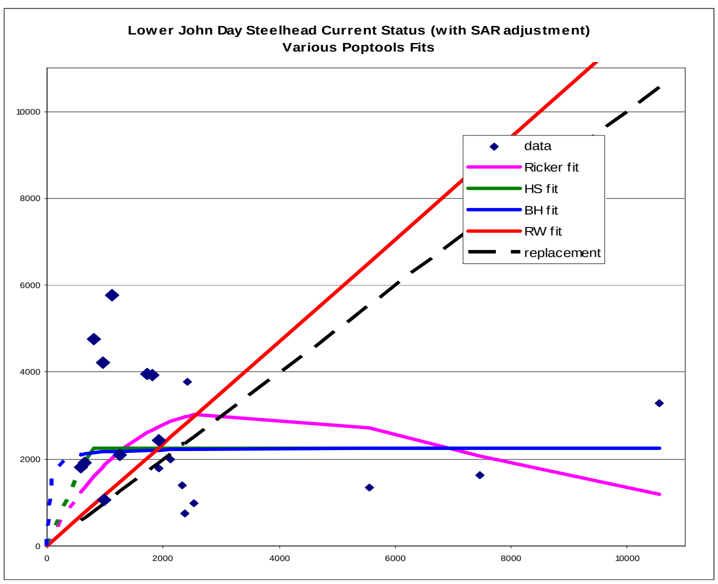


Figure 6-4h. Stock-recruitment curves for the Lower John Day River population. Data not adjusted for marine survival.

Figure 6-4i. Stock-recruitment curves for the Lower John Day River population. Data adjusted for marine survival.



6.1.5 North Fork John Day River Steelhead Population

The North Fork John Day steelhead population (Figure 6-5a) is part of the Mid-Columbia Steelhead ESU which has four major population groupings, including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers and the Yakima River group. The ESU contains three major life history categories: summer run, winter run, and summer-winter run combination. The North Fork population is a summer run and resides in the John Day River MPG.

The ICTRT classified the North Fork population as a “large” population (Table 6-5a) based on historical habitat potential (ICTRT 2005). A steelhead population classified as large has a mean minimum abundance threshold criteria of 1,500 naturally produced spawners with a sufficient intrinsic productivity (greater than 1.35 recruits per spawner at the threshold abundance level) to achieve a 5% or less risk of extinction over a 100-year timeframe.

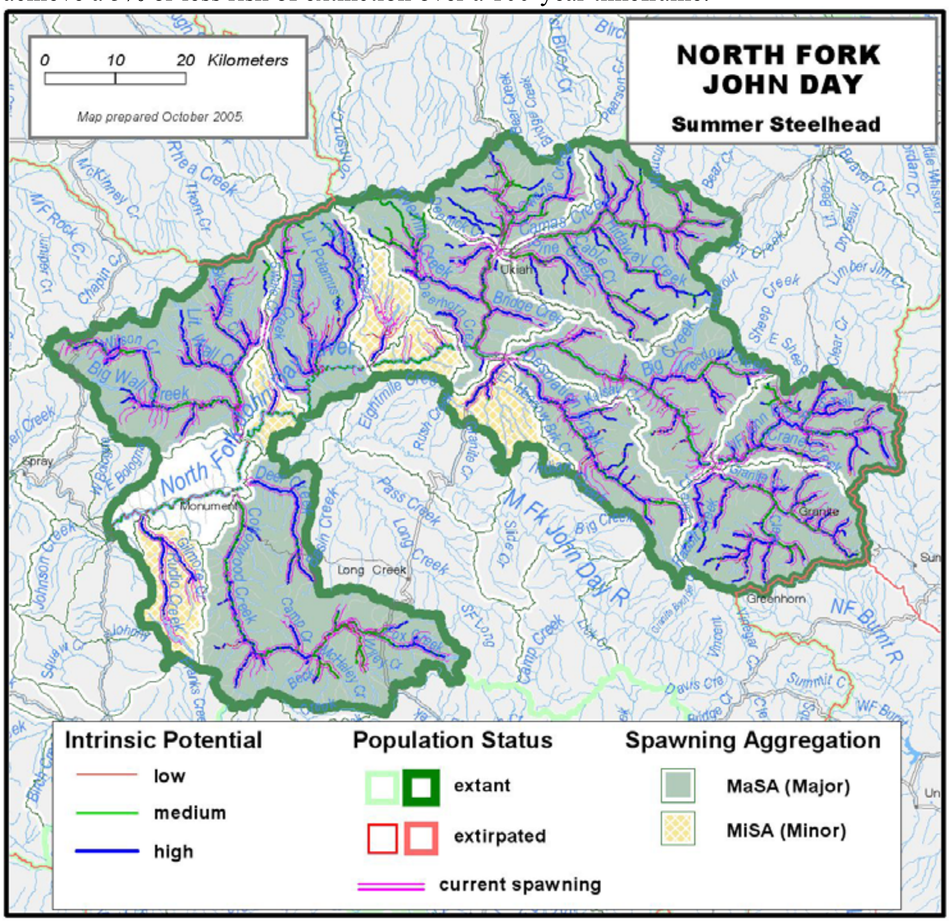


Figure 6-5a. North Fork John Day River Steelhead population boundaries and major and minor spawning areas.

Table 6-5a. North Fork John Day River Steelhead Basin Statistics

Drainage Area (km2)	4,788
Stream lengths km* (total)	1,823
Stream lengths km* (below natural barriers)	1,678
Branched stream area weighted by intrinsic potential (km2)	5.996
Branched stream area km2 (weighted and temp. limited)	5.969
Total stream area weighted by intrinsic potential (km2)	7.711
Total stream area weighted by intrinsic potential (km2) temp limited	7.428
Size / Complexity category	Large / B (dendritic)
Number of MaSAs	10
Number of MiSAs	5

*All stream segments greater than or equal to 3.8m bankfull width were included

**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C.

Current Abundance and Productivity

Current (1965 to 2005) abundance (number of adult spawners in natural production areas) has ranged from 369 (1990) to 10,235 (1965) (Figure 6-5b). Abundance estimates are based on expanded redd counts. ODFW, John Day district, index surveys of steelhead redds were used for the historical data set. We used index surveys that showed relatively consistent visitation through years. Survey data from Beaver, Fox, North Fork Trail, Middle Fork Trail, Wall, and Wilson creeks were used in the analyses. The current spawning distribution was used for the miles of available habitat within each population's range. The index redd densities were then multiplied by a correction factor based on the ratio of index densities to EMAP densities for 2004-05. This ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (.355 x index density) was multiplied by the total miles of currently utilized spawning habitat. Total annual redds were converted to fish by multiplying total annual redds by fish per redd. Fish/redd ratios were developed from survey data on Deer Creek in the Grande Ronde basin. The ratio is an average from four years of data of complete and repeated surveys (census) of redds above a weir where we have a complete count. The average fish per redd estimate from Deer Creek was 2.1.

The hatchery/wild composition of spawners was computed for the Lower Mainstem separately, and combined for all other populations. Data used to represent the North Fork included observations of positively identified adipose fin-clipped spawners (1992-present) from spawning survey observations in the four populations above the Lower Mainstem, and observations from rotary screwtrap and seine collections of adults (2000-present). There is evidence from the Deschutes that hatchery straying was substantially lower before 1992, and because the source of the strays in the John Day Basin is the same as the Deschutes we are assuming a similar trend. No other data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled fish collected during the 1980s. All samples were unmarked fish from locations above Tumwater Falls.

Recent year natural spawners include returns originating from naturally spawning parents, and a small fraction of strays from the Snake and Columbia River hatchery programs. Spawners originating from naturally spawning parents have comprised an average of 93%, since hatchery strays were documented in 1992. Since that time, the percentage of natural spawners has ranged from 87% to 99%.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 1,740 (1,898 total spawners) (Table 6-5b). During the period 1973-1997, returns per spawner for steelhead in the North Fork John Day River ranged from 0.10 (1985) to 3.07 (1991). The most recent 20-year (1978-1997) SAR adjusted and delimited geometric mean of returns per spawner was 2.41 (Table 6-5b).

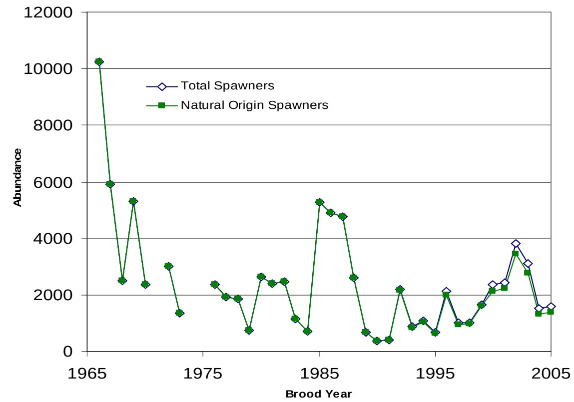


Figure 6-5b. North Fork John Day abundance estimates 1966-2005. Estimates based on expanded redd counts.

Table 6-5b. North Fork John Day River abundance and productivity measures

10-year geomean natural abundance	1740
20-year return/spawner productivity	1.17
20-year return/spawner productivity, SAR adj. and delimited*	2.41
20-year Bev-Holt fit productivity, SAR adjusted	n/a
20-year Lambda productivity estimate	1.09
Average proportion natural origin spawners (recent 10 years)	0.93
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds median parent escapement. This approach attempts to remove density dependence effects that may influence the productivity estimate.

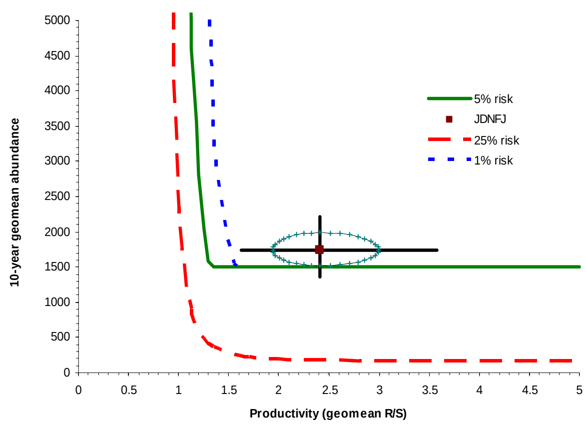


Figure 6-5c. North Fork John Day River Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Estimate includes a 1 SE ellipse, 1.81 X SE abundance line, and 1.81 X SE productivity line.

Comparison to the Viability Curve

- Abundance: 10-yr geomean natural origin spawners
- Productivity: 20-yr geomean R/S (adjusted for marine survival and delimited at 1115 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The North Fork John Day population is at VERY LOW risk based on current abundance and productivity. The point estimate for abundance and productivity resides above the 1% risk curve (Figure 6-5c). The lower end of the adjusted productivity standard error is above the 1% risk curve.

Spatial Structure and Diversity

The ICTRT has identified ten major spawning areas (MaSAs) and five minor spawning areas (MiSAs) within the North Fork John Day steelhead population (Figure 6-5d). Spawning is distributed broadly throughout the population boundaries including mainstem areas of Cottonwood, Camas, Desolation, and Granite creeks, the Upper North Fork John Day River as well as in many tributaries. Spawners within the North Fork are primarily natural origin fish; however, outside ESU hatchery fish, primarily from Snake River stocks, are present in the North Fork population.

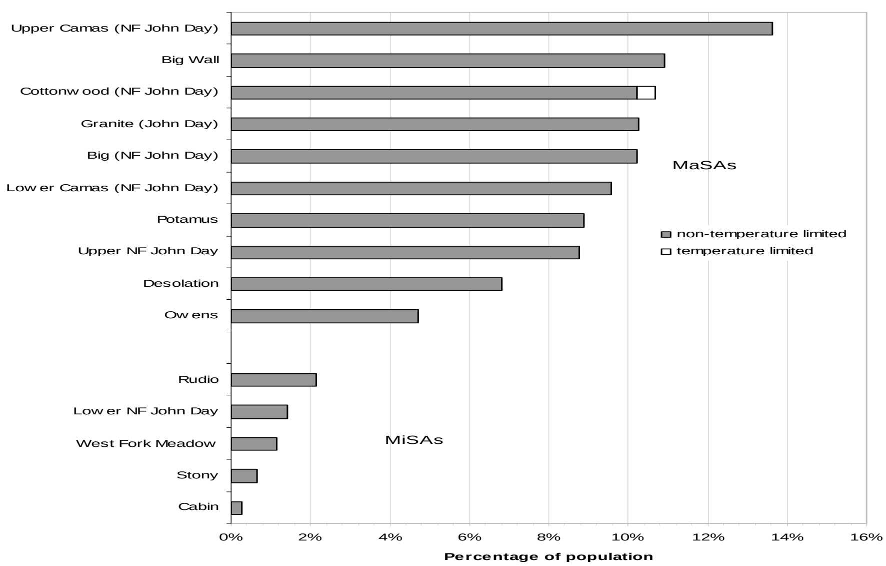


Figure 6-5d. Percentage of historical spawning habitat by major/minor spawning area in the John Day North Fork. Temperature limited portions of each MiSA/MaSA are shown in white.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas. The North Fork population has ten MaSAs and five MiSAs which are distributed in a complex dendritic pattern. Based on the ODFW spawner distribution database all of the major and minor spawning areas are currently occupied and a total of 1,194 km are presently used for spawning (Figure 6-5e). The North Fork population rates at **very low risk** for this metric because it has more than four MaSAs occupied in a dendritic configuration.

A.l.b. Spatial extent or range of population.
The current spawner distribution mirrors the historical distribution represented by the intrinsic potential analyses. All MaSAs and MiSAs are currently occupied (Figure 6-5e). The current spatial extent and range criteria rating for the North Fork population is **very low risk**. Index area spawning surveys are conducted in six spawning tributaries in the North Fork population. Recent spawning survey results will be analyzed for future viability assessment updates.

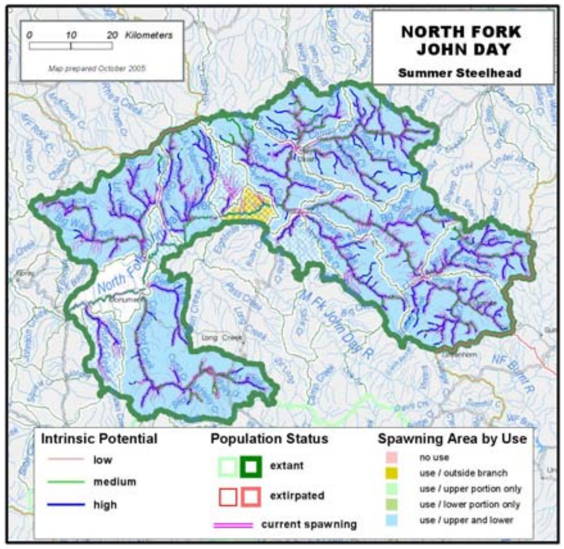


Figure 6-5e. North Fork John Day Steelhead distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.
There have been no increases in gaps between spawning areas nor any loss of use within MiSAs. Connectivity between historic spawning areas has remained relatively unchanged. The North Fork population rates at **very low risk** for gaps.

B.1.a. Major life history strategies.
Limited data exist for evaluating specific life history patterns of North Fork John Day steelhead, and therefore we use habitat information to infer changes in life history strategies. A significant proportion of the North Fork population resides in wilderness area with habitat conditions that are relatively unaltered. Habitat conditions throughout the population do theoretically provide the opportunity for expression of all historic life history strategies. The North Fork John Day population is a Type-A with predominate ages at ocean migration of Age 2 and Age 3, and adults return primarily as one-ocean or two-ocean fish. These life history patterns are consistent with what we observe for most Type-A populations. We have no evidence of loss of major life history strategies, thus the rating is **very low risk** for this metric.

B.1.b. Phenotypic variation.
Data were not available to evaluate if any phenotypic traits have been lost. We used habitat information to infer potential changes in phenotypic traits. Habitat conditions and absence of significant phenotypic selective pressures indicate that the population is at **very low risk** for loss of phenotypic traits.

B.1.c. Genetic variation.
Limited genetics data exist for John Day steelhead populations, and the samples are limited in geographic and temporal scope with only one sample from the North Fork population. The populations within the John Day are not well differentiated from one another. There is no biological basis to explain why the samples did not show normal differentiation. There are no past events, such as severe population bottlenecks or hatchery outplanting that would explain these results. There are out-of-ESU strays in the John Day Basin but the degree of introgression is unknown, and the past genetics samples, which were collected in the 1980s, were taken at a time when stray proportions were likely lower than in recent years. We have assigned a rating of **low risk** for this metric. This rating is driven by the balance between apparent similarity within and between populations and the relative degree of differentiation. Samples were collected in 2005 that will better inform the risk assessment for genetic variation in the future and ensure that the low risk rating is maintained through time.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. Available data were inadequate to estimate the out-of-ESU hatchery fraction specifically for the North Fork population. The estimates derived were based on data from a composite of the four populations (South Fork, Middle Fork, Upper John Day, North Fork) in the John Day that are above the Lower John Day population. These estimates were calculated from observations from spawning surveys and kelt collections seined from the mainstem. Since 1992, the estimated hatchery fraction ranged from 0.01-0.13. The mean hatchery fraction was 0.067. Based on recovery of coded wire tagged hatchery fish, primarily from angler caught fish, the majority of stray hatchery fish originate from Snake River hatcheries. Given that the hatchery fraction of out-of-ESU strays is estimated to be greater than 0.05 for two or more generations, the rating is **high risk** for this metric.

(2) *Out-of-MPG strays from within the ESU*. There have been four coded wire tagged fish recovered in the John Day from out-of-MPG within ESU origin. Three originated from the Umatilla Hatchery program and one from the Deschutes. It appears very few within ESU hatchery fish stray into the John Day, thus the rating is **low risk** for this metric.

(3) *Out-of-population within MPG strays*. There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk**.

(4) *Within-population hatchery spawners.* There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk**.

B.3.a. Distribution of population across habitat types.

The intrinsic potential distribution of the North Fork steelhead population encompassed six Level 4 ecoregions with the John Day Clarno Highlands and Mesic Forest zone comprising slightly over 60% of the distribution (Table 6-5c). There has been little change in ecoregion distribution between intrinsic and current distribution with all six ecoregions currently occupied at nearly identical proportions as the intrinsic distribution (Figure 6-5f). There have been no substantial reductions in any of the ecoregions. The rating for this metric is **very low risk**.

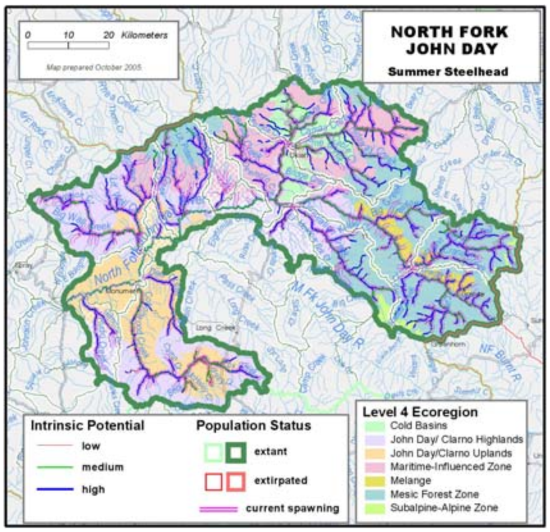


Figure 6-5f. North Fork John Day River Steelhead population distribution across various ecoregions.

Table 6-5c North Fork John Day River Steelhead—proportion of spawning areas across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Cold Basins	7.5	6.8
John Day Clarno Highlands	28.3	30.9
John Day Clarno Uplands	12.4	14.2
Maritime-Influenced Zone	15.7	13.1
Melange	3.6	3.9
Mesic Forest Zone	32.4	31.2

B.4.a. Selective change in natural processes or selective impacts.
Hydropower system: Although the hydrosystem and associated reservoirs likely pose some selective mortality on smolt outmigrants and adult migrants, the mortality would not appear to remove more than 25% of affected individuals. The likely impacts are rated as **low risk**.

Harvest: Recent harvest rates for group A steelhead are generally less than 10% annually. Although some harvest may be size selective for larger fish the selective mortality would not approach 25% of the larger fish, therefore the rating is **low**.

Hatcheries: No hatcheries are operated within this population. The risk rating is **very low**.

Habitat: There does not appear to be within basin habitat changes which would pose any significant selective mortality on adult or juvenile life stages. The risk rating is **very low**.

Spatial Structure and Diversity Summary

The combined integrated Spatial Structure/Diversity rating is low risk for the North Fork John Day population (Table 6-5d). The rating for Goal A "allowing natural rates and level of spatially mediated processes" was very low. The current spawner distribution mimics the intrinsic distribution. The population is distributed broadly across the landscape in numerous MaSAs and MiSAs. Good continuity exists between spawning areas and current gaps between spawning areas are similar to historic gaps.

The rating for Goal B "maintaining natural levels of variation" was low risk. However, there remains considerable uncertainty about the ratings for genetic variation and out-of-ESU hatchery strays in the natural spawners. Additional genetic analyses and interpretation is needed to determine if the genetic variation is similar to historic conditions and to examine evidence for degree of stray hatchery fish introgression. We rated the metric for out-of-ESU hatchery strays as very high. The data used for this rating is a composite from four John Day populations. Additional population specific spawner composition data is needed to improve the certainty of the out-of-ESU stray hatchery risk rating. If there is significant hatchery introgression that is affecting the genetic variation through time then the risk rating for "genetic variation" will increase and the overall risk rating for Goal B and Spatial Structure/Diversity will also increase.

Table 6-5d. Spatial structure and diversity scoring table.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	L (1)	L (1)	Mean=(1.5) Very Low Risk	Very Low Risk (1.5)	**Low Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	VL (2)	VL (2)			
B.1.a	VL (2)	VL (2)	Low (1)	Mean=(0.75) Low Risk	
B.1.b	VL (2)	VL (2)			
B.1.c	L (1)	L (1)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
B.2.a(2)	L (1)				
B.2.a(3)	VL (2)				
B.2.a(4)	VL (2)				
B.3.a	VL (2)	VL (2)	VL (2)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The overall viability rating for the North Fork John Day steelhead population is highly viable as a result of the Abundance/Productivity rating of very low risk, and the Spatial Structure/Diversity rating of low risk (Figure 6-5g). The Spatial Structure/Diversity metric ratings for genetic variation and out-of-ESU hatchery origin spawner composition were the most influential on the overall Spatial Structure/Diversity assessment. There is considerable uncertainty regarding the genetic effect of out-of-ESU strays as well as the actual proportion of natural spawners that are hatchery strays. There are limited population specific data to estimate the spawner composition in the North Fork population. Enhanced monitoring efforts should be undertaken to develop better estimates of the composition of North Fork John Day spawners.

Spatial Structure/Diversity Risk

Abundance/Productivity Risk		Very Low	Low	Moderate	High
	Very Low (<1%)	HV	**HV** North Fork JD	V	
	Low (<5%)	V	V	MV	
	Moderate (6-25%)				
	High >(25%)				

Figure 6-5g. Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV=Minimally Viable.

North Fork John Day Steelhead – Data Summary

Data type: Redd count expansions
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 6-5e. North Fork John Day Steelhead run data (used for curve fits and R/S analysis). Entries where the spawner number is less than the median escapement (1979-1998) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	adj R/S
1979	**757**	**1.00**	**757**	**1358**	**1.79**	**1.94**	**2633**	**3.48**
1980	2633	1.00	2633	3167	1.20	0.50	1599	0.61
1981	2390	1.00	2390	5041	2.11	0.68	3442	1.44
1982	2473	1.00	2473	4598	1.86	0.46	2101	0.85
1983	1153	1.00	1153	3383	2.94	0.52	1772	1.54
1984	**704**	**1.00**	**704**	**1521**	**2.16**	**0.65**	**984**	**1.40**
1985	5264	1.00	5264	522	0.10	0.46	240	0.05
1986	4895	1.00	4895	563	0.11	0.94	531	0.11
1987	4754	1.00	4754	1240	0.26	2.18	2699	0.57
1988	2603	1.00	2603	1460	0.56	0.99	1446	0.56
1989	**687**	**1.00**	**687**	**925**	**1.35**	**0.96**	**889**	**1.29**
1990	**369**	**1.00**	**369**	**955**	**2.59**	**2.83**	**2703**	**7.33**
1991	**415**	**1.00**	**415**	**1274**	**3.07**	**2.33**	**2973**	**7.16**
1992	2185	0.99	2154	1425	0.65	1.88	2679	1.23
1993	**867**	**0.99**	**855**	**1036**	**1.19**	**1.18**	**1224**	**1.41**
1994	**1078**	**0.97**	**1050**	**1385**	**1.29**	**1.07**	**1483**	**1.38**
1995	**683**	**0.94**	**640**	**1922**	**2.82**	**1.23**	**2355**	**3.45**
1996	2122	0.93	1981	2309	1.09	1.03	2383	1.12
1997	**1013**	**0.95**	**961**	**2823**	**2.79**	**0.76**	**2155**	**2.13**
1998	**1021**	**0.96**	**978**	**2930**	**2.87**	**0.49**	**1437**	**1.41**
1999	1660	0.98	1626					
2000	2350	0.91	2143					
2001	2448	0.91	2230					
2002	3828	0.90	3444					
2003	3093	0.89	2758					
2004	1527	0.87	1328					
2005	1602	0.87	1393					

Table 6-5f. Geomean abundance and productivity estimates. Current abundance and productivity values are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	2.07	2.07	2.41	2.41	1.01	1.09	1740
Std. Err.	0.12	0.12	0.22	0.22	0.02	0.15	0.13
count	10	10	10	10	12	20	10

Table 6-5g. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.17	0.27	n/a	n/a	0.71	0.55	62.0	1.15	0.30	n/a	n/a	1.09	0.46	67.8
Const. Rec	1653	228	n/a	n/a	n/a	n/a	42.1	1622	230	n/a	n/a	n/a	n/a	43.2
Bev-Holt	12.92	19.48	1871	441	0.18	0.72	44.4	50.00	68.78	1665	252	0.35	0.39	46.4
Hock-Stk	2.03	0.46	951	266	0.21	0.64	43.5	4.68	0.10	347	1	0.34	0.39	46.0
Ricker	3.76	0.60	0.00061	0.00007	0.13	0.59	31.5	4.32	0.86	0.00070	0.00008	0.29	0.11	40.1

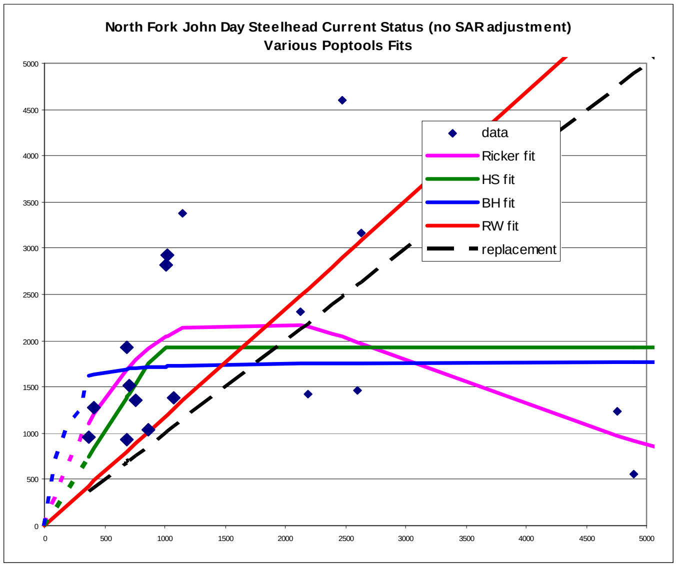


Figure 6-5g. Stock-recruitment curves for the North Fork John Day River population. Data not adjusted for marine survival.

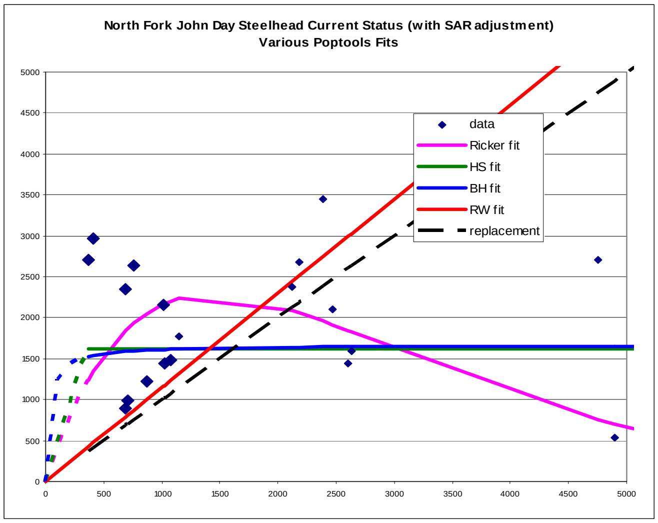


Figure 6-5h Stock recruitment curves for the North Fork John Day River Population. Data adjusted for marine survival.

6.1.6 Middle Fork John Day River Steelhead Population

The Middle Fork John Day steelhead population (Figure 6-6a) is part of the Mid-Columbia Steelhead ESU which has four major population groupings, including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers and the Yakima River group. The ESU contains three major life history categories: summer run, winter run, and summer-winter run combination. The Middle Fork population is a summer run and resides in the John Day River MPG.

The ICTRT classified the Middle Fork population as an “Intermediate” sized population (Table 6-6a). A steelhead population classified as intermediate has a mean minimum abundance threshold of 1,000 natural spawners with a sufficient intrinsic productivity (greater than 1.4 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk of extinction over a 100-year timeframe.

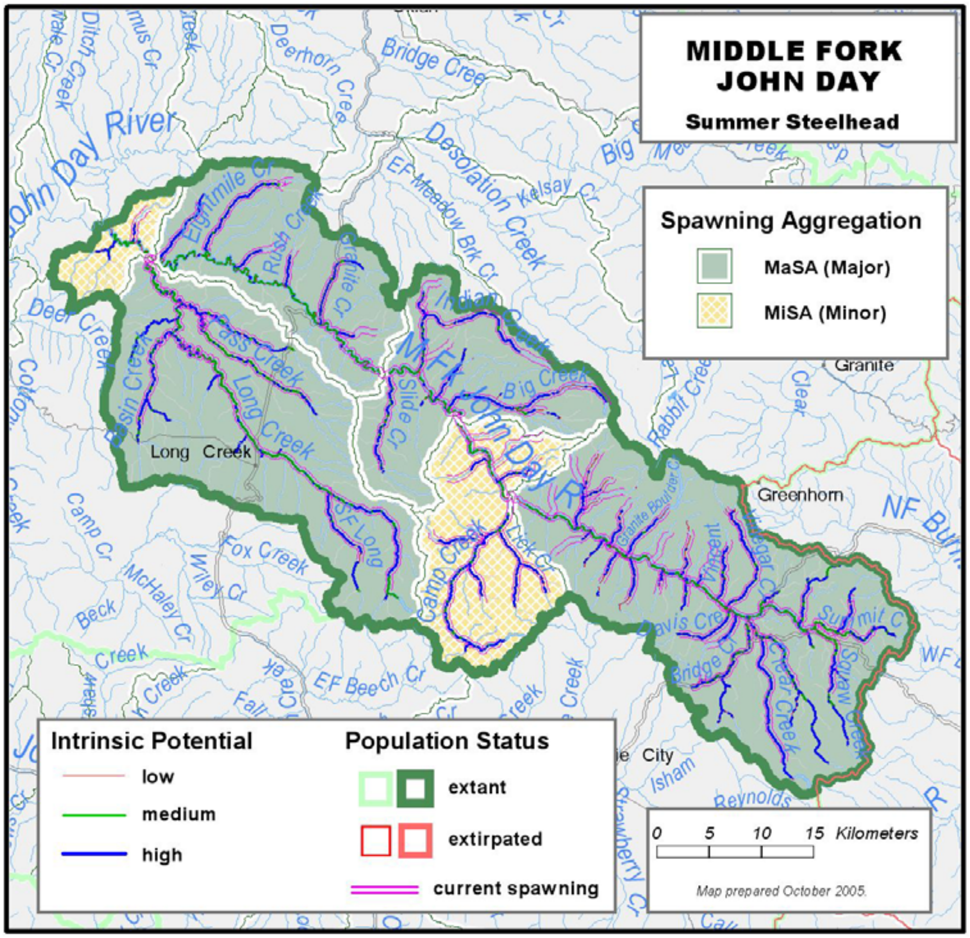


Figure 6-6a. Middle Fork John Day River Steelhead population boundaries major and minor spawning areass.

Table 6-6a. Middle Fork John Day River Steelhead basin statistics.

Drainage Area (km2)	2,052
Stream lengths km* (total)	704
Stream lengths km* (below natural barriers)	690
Branched stream area weighted by intrinsic potential (km2)	2.312
Branched stream area km2 (weighted and temp. limited)**	2.312
Total stream area weighted by intrinsic potential (km2)	3.001
Total stream area weighted by intrinsic potential (km2) temp limited**	3.001
Size / Complexity category	Intermediate / B (dendritic structure)
Number of MaSAs	4
Number of MiSAs	2

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22ºC.

Current Abundance and Productivity

Current (1966 to 2005) abundance (number of adult spawners in natural production areas) has ranged from 337 (2005) to 3,538 (1979) (Figure 6-6b). Abundance estimates are based on expanded redd counts. ODFW, John Day district, index surveys of steelhead redds were used for the historical data set. We used index surveys that showed relatively consistent visitation through years. Survey data from Beaver, Camp, Deep, and Lick creeks were used in the analyses. The current spawning distribution was used for the miles of available habitat within each population's range. The index redd densities were then multiplied by a correction factor based on the ratio of index densities to EMAP densities for 2004-05. This ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (.355 x index density) was multiplied by the total miles of currently utilized spawning habitat. Total annual redds were converted to fish by multiplying total annual redds by fish per redd. Fish/redd ratios were developed from survey data on Deer Creek in the Grande Ronde Basin. The ratio is an average from four years of data of complete and repeated surveys (census) of redds above a weir where we have a complete count. The average fish per redd estimate from Deer Creek was 2.1.

The hatchery/wild composition of spawners was computed for the Lower mainstem separately, and combined for all other populations. Data used to represent the Middle Fork included observations of positively identified adipose fin-clipped spawners (1992-present) from spawning survey observations in the four populations above the Lower Mainstem, and observations from rotary screw trap and seine collections of adults (2000-present). There is evidence from the Deschutes that hatchery straying was substantially lower before 1992, and because the source of strays in the John Day Subbasin is the same as the Deschutes we are assuming a similar trend. No other data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled fish collected during the 1980's. All samples were unmarked fish from locations above Tumwater Falls.

Recent year natural spawners include returns originating from naturally spawning parents, and a small fraction of strays from the Snake and Columbia River hatchery programs. Spawners originating from naturally spawning parents have comprised an average of 93%, since hatchery strays were documented in 1992. Since that time, the percentage of natural spawners has ranged from 87% to 99%.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 756 (Table 6-6b). During the period 1969-1998, returns per spawner for steelhead in the Middle Fork John Day River ranged from 0.17 (1992) to 3.84 (1997). The most recent 20-year (1979-1998) geometric mean of returns per spawner SAR adjusted and median delimited was 1.93 (Table 6-6b).

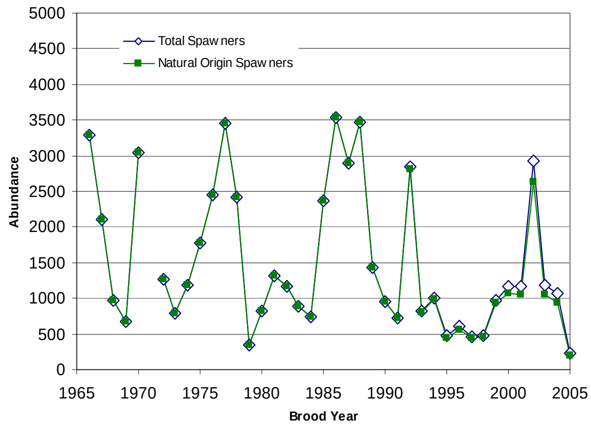


Figure 6-6b. Middle Fork John Day abundance estimates 1966-2005. Estimates based on redd count expansions.

Table 6-6b. Middle Fork John Day River abundance and productivity measures.

10-year geomean natural abundance	756
20-year return/spawner productivity	1.17
20-year return/spawner productivity, SAR adj. and delimited* at the median	1.93
20-year Bev-Holt fit productivity, SAR adjusted	n/a
Lambda productivity estimate	1.02
Average proportion natural origin spawners (recent 10 years)	93%
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds the median. This approach attempts to remove density dependence effects that may influence the productivity estimate.

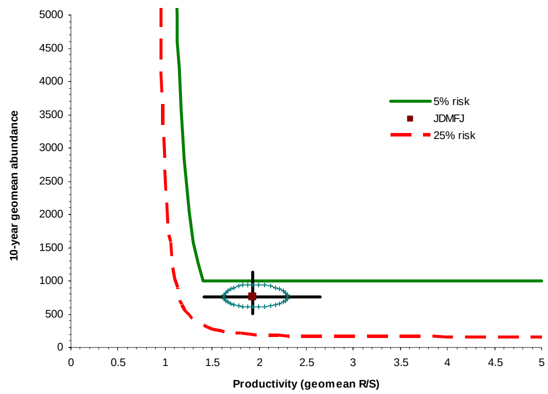


Figure 6-6c. Middle Fork John Day River Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Estimate is shown with a 1 SE ellipse, 1.81 X SE abundance line, and 1.81 X SE. productivity line.

Comparison to the Viability Curve

- Abundance: 10-year geomean natural origin spawners
- Productivity: 20-year geomean R/S (adjusted for marine survival and delimited at 922 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Middle Fork John Day population is at MODERATE risk based on current abundance and productivity. The productivity is low risk because the point estimate is at the low risk level and the adjusted standard error is above the 5% risk level. The abundance is moderate risk because the point estimate is between 5% and 25% risk curves (Figure 6-6c).

Spatial Structure and Diversity

The ICTRT has identified four major spawning areas (MaSAs) and two minor spawning areas (MiSAs) within the Middle Fork John Day steelhead population (Figure 6-6d). Spawning is distributed broadly throughout the population boundaries including mainstem areas in the lower and upper Middle Fork John Day and Long Creek. There are numerous tributary spawning streams distributed from the lower end of the population boundary to the uppermost reaches. Spawners within the Middle Fork are primarily natural origin fish; however, outside ESU hatchery fish, primarily from Snake River stocks, are present in the Middle Fork population.

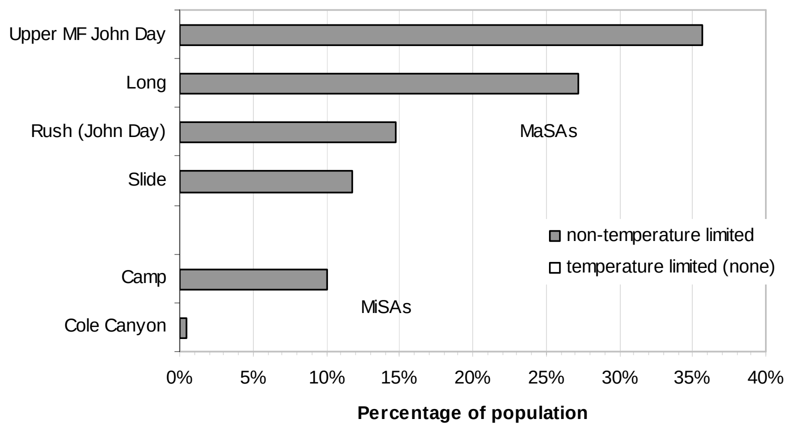


Figure 6-6d. Percentage of historical spawning habitat by major/minor spawning area in the Middle Fork John Day River. There are no temperature limited portions in this population.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.
The Middle Fork population has four MaSAs and two MiSAs which are distributed in a complex dendritic pattern. Based on the ODFW spawner distribution database all of the major and minor spawning areas are occupied, and a total of 546 km are currently used for spawning (Figure 6-6e). The Middle Fork population rates at **very low risk** because it has four MaSAs occupied in a dendritic configuration.

A.l.b. Spatial extent or range of population.
The current spawner distribution mirrors the historical distribution as represented by the intrinsic potential analyses. All MaSAs and MiSAs are currently occupied (Figure 6-6e). The current spatial extent and range criteria are rated as **very low risk** for the Middle Fork population. There are four index spawning survey reaches in the Middle Fork population. Recent spawning ground surveys results will be analyzed for future viability assessments.

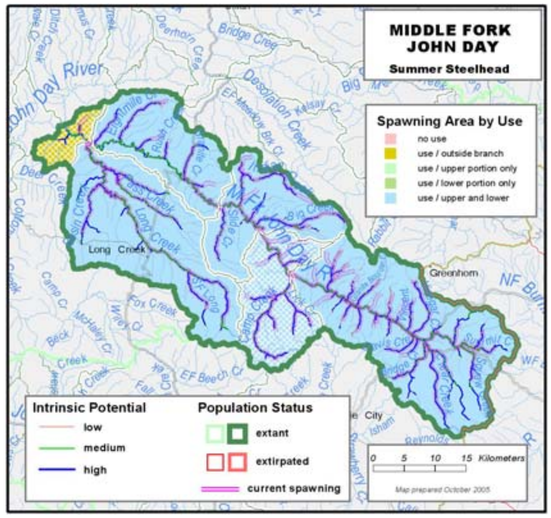


Figure 6-6e. Middle Fork John Day Steelhead distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.
There has been little or no increase in gaps or loss in continuity between spawning areas within the Middle Fork population. Thus, the Middle Fork population rates as **very low risk** for gaps and continuity.

B.1.a. Major life history strategies.
There are no direct observations to assess loss in major life history strategies for the Middle Fork John Day steelhead population, therefore we infer loss of life history diversity based on habitat changes. Although habitat conditions have been altered through time, particularly temperature, there remains the theoretical opportunity to express diverse life history strategies similar to intrinsic potential. Juvenile steelhead exhibit diverse patterns of movement throughout the life cycle and rear in a variety of habitat types. Middle Fork steelhead are Type-A steelhead and appear to exhibit typical Type-A age at outmigration and ocean residence duration. The rating for loss of life history strategies is **low risk** for this metric.

B.1.b. Phenotypic variation.
Current habitat conditions are not such that selective pressures would have significantly changed or eliminated any phenotypic traits. Mainstem migrating corridor temperature changes and temperature changes in the John Day River have likely altered juvenile migration timing thus reducing trait variability. We hypothesize that conditions have not altered the mean or variability of traits to the point that the risk level rises to moderate. Current habitat conditions and absence of other significant phenotypic selective pressure indicate that the Middle Fork population is at **low risk** for this metric.

B.1.c. Genetic variation.

There are limited genetics data for John Day steelhead populations and only one sample from the Middle Fork population. The samples from populations within the John Day are not well differentiated from one another. However, these samples were taken from a relatively small geographic area over a short time frame. There is no biological basis for the low level of differentiation. Samples were collected in the mid-1980s before any significant potential affects of hatchery strays. There have been no bottlenecks or other demographic factors that would have resulted in genetic variation impairment. There are out-of-ESU strays in the Middle Fork, however the degree of introgression is unknown. We have assigned a rating of **low risk** for this metric. This rating is driven by balance between apparent absolute similarity within and between populations and the relative degree of differentiation within and between the John Day populations. Samples from multiple locations were collected in 2005 and will be analyzed to better inform the risk rating for this metric in the future.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. Inadequate data exist to estimate the out-of-ESU hatchery fraction specifically for the Middle Fork population. Estimates we used in this assessment were based on data from a composite of the four populations (South Fork, Middle Fork, Upper John Day, North Fork) in the John Day that are above the Lower Mainstem John Day population. These estimates are based on observations from spawning surveys and kelt collections seined from the mainstem. Since 1992, the estimated hatchery fraction ranged from 0.01-0.13. The mean hatchery fraction was 0.067. Based on recovery of coded wire tagged hatchery fish, primarily from angler caught fish, the majority of stray hatchery fish originate from Snake River hatcheries. Given that the hatchery fraction of out-of-ESU strays is estimated to be greater than 0.05 for two or more generations, the rating is **high risk** for this metric.

(2) *Out-of-MPG strays from within the ESU*. There have been four coded wire tagged fish recovered in the John Day from out-of-MPG within ESU origin. Three originated from the Umatilla Hatchery program and one from the Deschutes. It appears very few within ESU hatchery fish stray into the John Day, thus the rating is **low risk** for this metric.

(3) *Out-of-population within MPG strays*. There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk**.

(4) *Within-population hatchery spawners.* There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk**.

B.3.a. Distribution of population across habitat types.

The intrinsic potential distribution of the Middle Fork population encompassed four ecoregions with the John Day Clarno Highlands and John Day Clarno Uplands being the dominant ecoregions (Figure 6-6f). There has been little change in ecoregion distribution between intrinsic and current. All MaSAs in the intrinsic distribution are currently occupied in a similar distribution pattern (Table 6-6c). The rating is **low risk** for this metric.

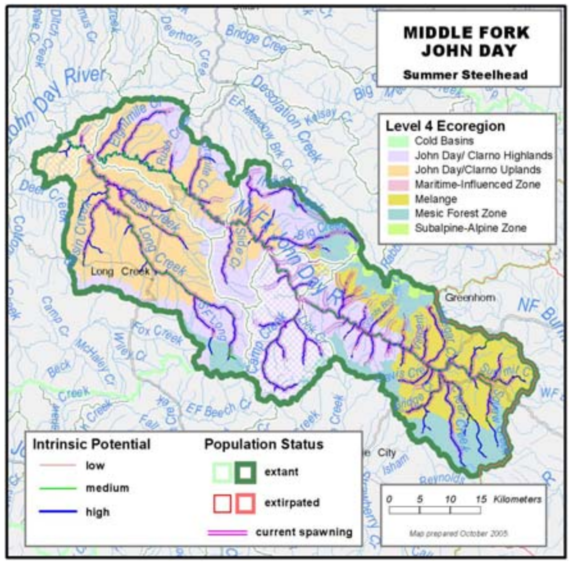


Figure 6-6f. Middle Fork John Day River steelhead population distribution across various ecoregions.

Table 6-6c. Middle Fork John Day River Steelhead—proportion of spawning area across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
John Day Clarno Highlands	30.1	37.7
John Day Clarno Uplands	39.0	36.1
Melange	23.8	22.7
Mesic Forest Zone	7.1	3.6

B.4.a. Selective change in natural processes or selective impacts.
Hydropower system: Although the hydrosystem and associated reservoirs likely pose some selective mortality on smolt outmigrants and adult migrants, the mortality would not appear to remove more than 25% of affected individuals. The likely impacts are rated as **low risk** for this metric.

Harvest: Recent harvest rates for group A steelhead are generally less than 10% annually. Although some harvest may be size selective for larger fish the selective mortality would not approach 25% of the larger fish, therefore the rating is **low risk** for this metric.

Hatcheries: No hatcheries are operated within this population. The rating is **very low risk** for this metric.

Habitat: There does not appear to be within basin habitat changes which would pose significant selective mortality on adult or juvenile life stages. The rating is **low risk** for this metric.

Spatial Structure and Diversity Summary

The integrated Spatial Structure/Diversity rating is low risk for the Middle Fork population (Table 6-6d). The rating for Goal A "allowing natural rates and levels of spatially mediated processes" was between very low and low risk. The current spawner distribution of the Middle Fork population mimics the intrinsic distribution. The population is distributed broadly across the landscape, in multiple MaSAs with adequate gaps and good continuity between spawning areas.

The rating for Goal B "maintaining natural levels of variation" was low risk. However, additional genetics analyses are needed to better assess genetic variation and hatchery introgression. This population was rated high risk for proportion of out-of-ESU hatchery strays based on a limited time series of composite John Day population data. Better population specific spawner composition data are needed to better understand the out-of-ESU hatchery stray influence. If there is significant hatchery introgression that affects genetic variation through time, then the risk rating will increase, thus raising the overall risk rating for Goal B and the overall rating for Spatial Structure/Diversity.

Table 6-6d. Spatial structure and diversity scoring table.

<table>
<tr><th rowspan="2">Metric</th><th colspan="5">Risk Assessment Scores</th></tr>
<tr><th>Metric</th><th>Factor</th><th>Mechanism</th><th>Goal</th><th>Population</th></tr>
<tr><td>A.1.a</td><td>L (1)</td><td>L (1)</td><td rowspan="3">Mean=(1.5)
Very Low/Low Risk</td><td rowspan="3">Very Low/Low Risk (1.5)</td><td rowspan="14">Low Risk</td></tr>
<tr><td>A.1.b</td><td>VL (2)</td><td>VL (2)</td></tr>
<tr><td>A.1.c</td><td>VL (2)</td><td>VL (2)</td></tr>
<tr><td>B.1.a</td><td>L (1)</td><td>L (1)</td><td rowspan="3">Low (1)</td><td rowspan="11">Mean=(0.5)
Low Risk</td></tr>
<tr><td>B.1.b</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.1.c</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.2.a(1)</td><td>H (-1)</td><td rowspan="4">High Risk
(-1)</td><td rowspan="4">High Risk (-1)</td></tr>
<tr><td>B.2.a(2)</td><td>L (1)</td></tr>
<tr><td>B.2.a(3)</td><td>VL (2)</td></tr>
<tr><td>B.2.a(4)</td><td>VL (2)</td></tr>
<tr><td>B.3.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.4.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
</table>

Overall Viability Rating

The overall rating for the Middle Fork John Day Steelhead population does not currently meet the ICTRT recommended viability criteria (Figure 6-6g). The 10-year geometric mean abundance of 756 is below the minimum 1,000 threshold. The productivity point estimate of 1.93 as well as the lower end of the adjusted standard error met the low risk criteria. Increased annual abundance would allow this population to achieve a risk rating of low for abundance/productivity and raise the overall viability rating to viable.

Spatial Structure/Diversity Risk

Abundance/ Productivity Risk		Very Low	Low	Moderate	High
	Very Low (<1%)	HV	HV	V	
	Low (<5%)	V	V	MV	
	Moderate (6-25%)		Mid Fork JD		
	High >(25%)				

Figure 6-6g. Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV= Minimally Viable.

Middle Fork John Day Steelhead – Data Summary

Data type: Redd count expansions
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 6-6e. Middle Fork John Day Steelhead run data (used for curve fits and R/S analysis). Entries where the spawner number is less than the median escapement (1979-1998) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	adj R/S
1979	**337**	**1.00**	**337**	**971**	**2.88**	**1.94**	**1882**	**5.58**
1980	**815**	**1.00**	**815**	**1749**	**2.15**	**0.50**	**883**	**1.08**
1981	1318	1.00	1318	2950	2.24	0.68	2015	1.53
1982	1160	1.00	1160	3238	2.79	0.46	1480	1.28
1983	**884**	**1.00**	**884**	**3008**	**3.40**	**0.52**	**1576**	**1.78**
1984	**739**	**1.00**	**739**	**2310**	**3.13**	**0.65**	**1494**	**2.02**
1985	2373	1.00	2373	1192	0.50	0.46	547	0.23
1986	3538	1.00	3538	1028	0.29	0.94	969	0.27
1987	2899	1.00	2899	1665	0.57	2.18	3625	1.25
1988	3471	1.00	3471	1726	0.50	0.99	1710	0.49
1989	1433	1.00	1433	849	0.59	0.96	816	0.57
1990	961	1.00	961	701	0.73	2.83	1984	2.07
1991	**716**	**1.00**	**716**	**500**	**0.70**	**2.33**	**1166**	**1.63**
1992	2851	0.99	2810	497	0.17	1.88	935	0.33
1993	**816**	**0.99**	**805**	**497**	**0.61**	**1.18**	**587**	**0.72**
1994	1008	0.97	981	737	0.73	1.07	789	0.78
1995	**480**	**0.94**	**450**	**1016**	**2.12**	**1.23**	**1245**	**2.59**
1996	**604**	**0.93**	**564**	**1215**	**2.01**	**1.03**	**1254**	**2.08**
1997	**460**	**0.95**	**436**	**1769**	**3.84**	**0.76**	**1350**	**2.93**
1998	**477**	**0.96**	**457**	**1762**	**3.69**	**0.49**	**864**	**1.81**
1999	965	0.98	945					
2000	1169	0.91	1066					
2001	1164	0.91	1061					
2002	2933	0.90	2639					
2003	1187	0.89	1058					
2004	1075	0.87	934					
2005	224	0.87	195					

Table 6-6f. Geomean abundance and productivity estimates. Current abundance and productivity values are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	2.10	2.34	1.93	2.45	0.97	1.02	756
Std. Err.	0.21	0.22	0.18	0.16	0.16	0.16	0.22
count	10	7	10	7	12	20	10

Table 6-6g. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.17	0.24	n/a	n/a	0.43	0.70	58.2	1.15	0.21	n/a	n/a	0.62	0.27	53.5
Const. Rec	1247	162	n/a	n/a	n/a	n/a	39.8	1224	123	n/a	n/a	n/a	n/a	29.3
Bev-Holt	50	302	1284	286	0.11	0.82	42.6	50	119	1259	154	0.20	0.03	32.2
Hock-Stk	2.88	1.66	439	259	0.10	0.83	42.4	3.98	22.87	307	1763	0.20	0.05	32.1
Ricker	2.99	0.67	0.00069	0.00013	0.15	0.76	43.8	2.71	0.52	0.000626	0.000113	0.27	-0.01	37.8

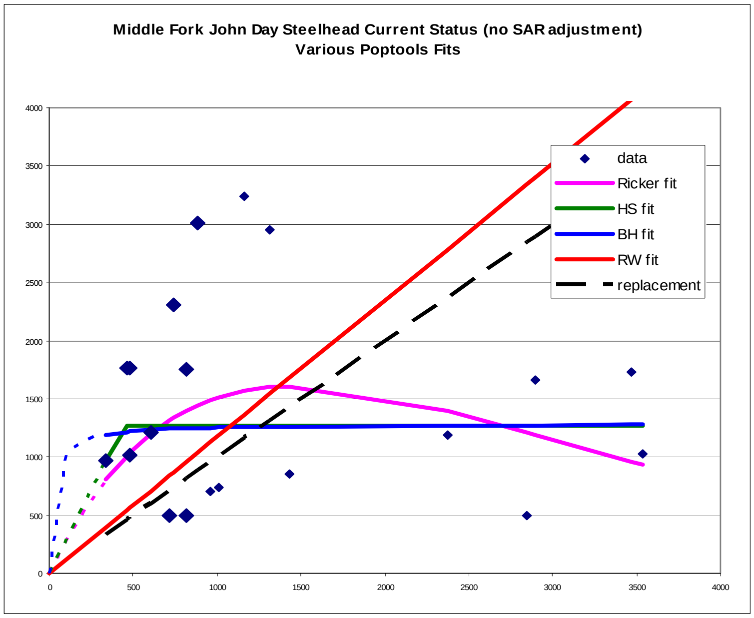


Figure 6-6h. Stock-recruitment curves for the Middle Fork John Day River population. Data not adjusted for marine survival.

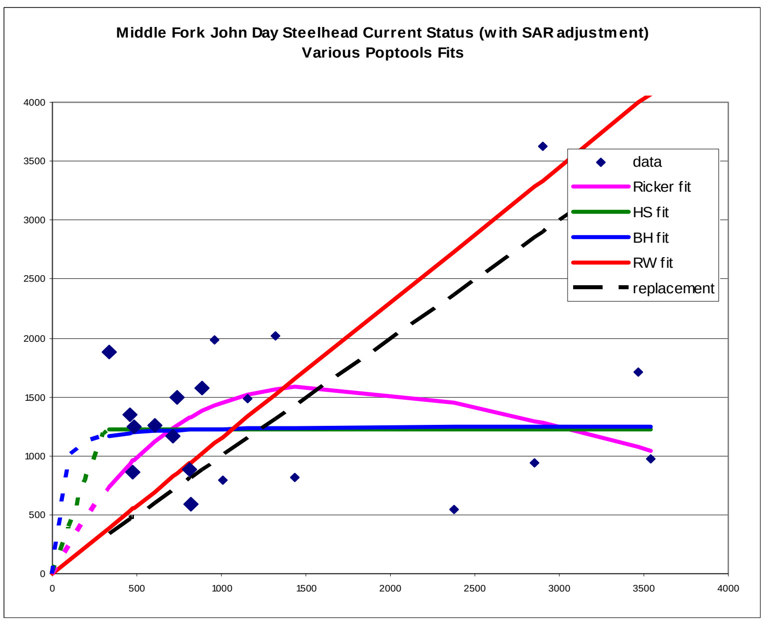


Figure 6-6i. Stock-recruitment curves for the Middle Fork John Day River population. Data adjusted for marine survival.

6.1.7 South Fork John Day River Steelhead Population

The South Fork John Day River steelhead population is part of the Mid-Columbia Steelhead ESU (Figure 6-7a) which has four major population groupings, including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers and the Yakima River group. The ESU contains three major life history categories: summer run, winter run, and summer-winter run combination. The South Fork population is a summer run and resides in the John Day River MPG.

The ICTRT classified the South Fork population as a "basic" population, which is the smallest population classification (Table 6-7a). A steelhead population classified as basic has a minimum abundance threshold criteria of 500 naturally produced spawners with a sufficient intrinsic productivity (greater than 1.65 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk of extinction over a 100-year timeframe.

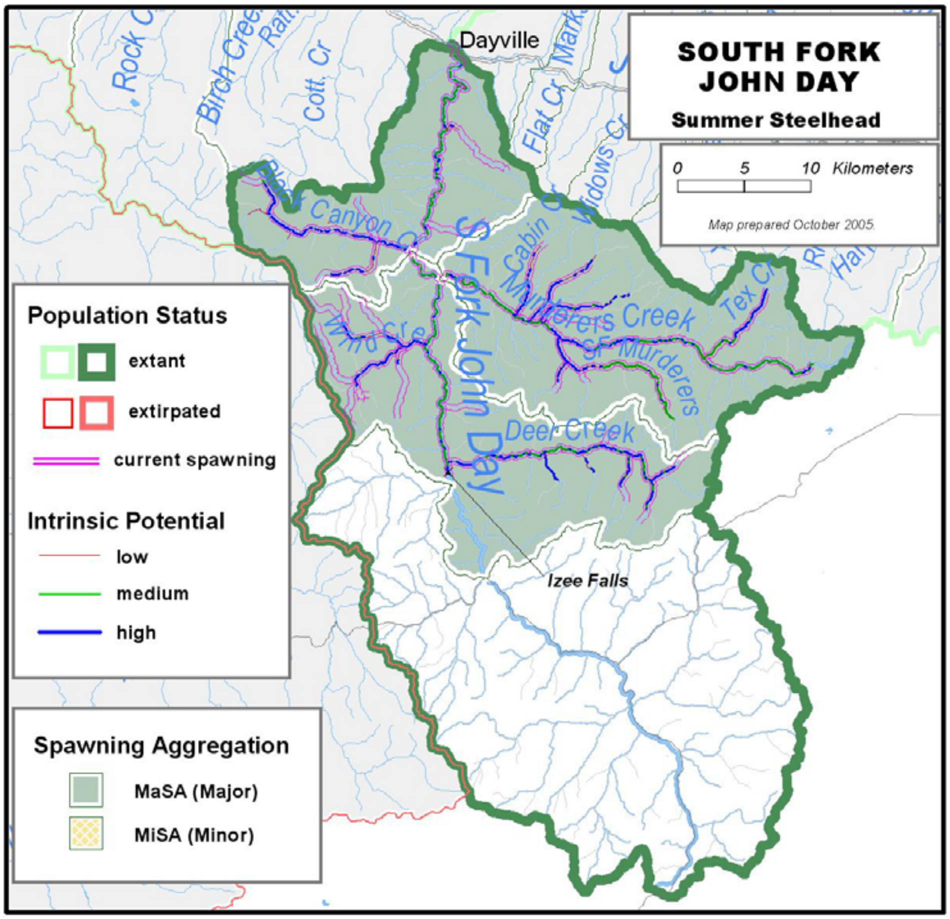


Figure 6-7a. South Fork John Day River Steelhead population boundaries and major and minor spawning areas

Table 6-7a. South Fork John Day River Steelhead Basin Statistics.

Drainage Area (km2)	1,570
Stream lengths km* (total)	451
Stream lengths km* (below natural barriers)	226
Branched stream area weighted by intrinsic potential (km2)	0.929
Branched stream area km2 (weighted and temp. limited)	0.929
Total stream area weighted by intrinsic potential (km2)	1.034
Total stream area weighted by intrinsic potential (km2) temp limited	1.034
Size / Complexity category	Basic / B (dendritic structure)
Number of MaSAs	3
Number of MiSAs	0

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22^{o}C.

Current Abundance and Productivity

Current (1960 to 2005) abundance (number of adult spawners in natural production areas) has ranged from 105 (1999) to 2,454 (1962) (Figure 6-7b). Abundance estimates are based on expanded redd counts. ODFW, John Day district, index surveys of steelhead redds were used for the historical data set. We used index surveys that showed relatively consistent visitation through years. Survey data from Black Canyon, Deer, upper Murderer's, lower Murderer's, Tex, and Wind creeks were used in the analyses. The current spawning distribution was used for the miles of available habitat within each population's range. The index redd densities were then multiplied by a correction factor based on the ratio of index densities to EMAP densities for 2004-05. This ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (.355 x index density) was multiplied by the total miles of currently utilized spawning habitat. Total annual redds were converted to fish by multiplying total annual redds by fish per redd. Fish/redd ratios were developed from survey data on Deer Creek in the Grande Ronde basin. The ratio is an average from four years of data of complete and repeated surveys (census) of redds above a weir where we have a complete count. The average fish per redd estimate from Deer Creek was 2.1.

The hatchery/wild composition of spawners was computed for the Lower mainstem separately, and combined for all other populations. Data used to represent the South Fork included observations of positively identified adipose fin-clipped spawners (1992-present) from spawning survey observations in the four populations above the Lower Mainstem, and observations from rotary screw trap and seine collections of adults (2000-present). There is evidence from the Deschutes that hatchery straying was substantially lower prior to 1992, and because the source of strays in the John Day Subbasin is the same as the Deschutes we assumed a similar trend. No other data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled fish collected during the 1980's. All samples were unmarked fish from locations above Tumwater Falls.

Recent year natural spawners include returns originating from naturally spawning parents, and a small fraction of strays from the Snake River and Columbia River hatchery programs. Spawners originating from naturally spawning parents have comprised an average of 93% since hatchery strays were documented in 1992. Since that time, the percentage of natural spawners has ranged from 87% to 99%.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 259 (Table 6-7b). During the period 1961-1998, returns per spawner for steelhead in the South Fork John Day River ranged from 0.20 (1987) to 13.54 (1968). The most recent 20 year (1979-1998) geometric mean of returns per spawner, adjusted for marine survival and median delimited was 1.95 (Table 6-7b).

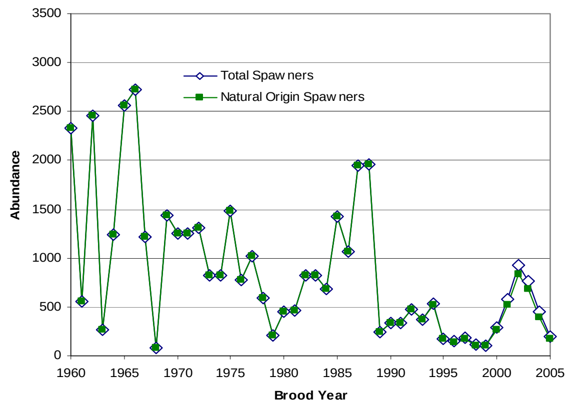


Figure 6-7b. South Fork John Day abundance estimates 1960-2005. Estimates based on redd expansions

Table 6-7b. South Fork John Day River abundance and productivity measures.

10-year geomean natural abundance	259
20-year return/spawner productivity	0.99
20-year return/spawner productivity, SAR adj. and delimited*	1.95
20-year Bev-Holt fit productivity, SAR adjusted	n/a
Lambda productivity estimate	1.14
Average proportion natural origin spawners (recent 10 years)	93%
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds median. This approach attempts to remove density dependence effects that may influence the productivity estimate.

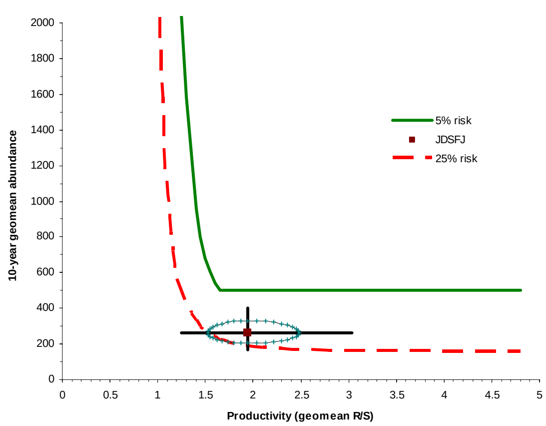


Figure 6-7c. South Fork John Day River Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Point estimate shown with a 1 SE ellipse, 1.81 X SE abundance line, and 1.81 X SE productivity line.

Comparison to the Viability Curve

- Abundance: 10-year geomean natural origin spawners
- Productivity: 20-year geomean R/S (adjusted for marine survival and delimited at 459 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The South Fork John Day population is at MODERATE risk based on current abundance and productivity. The point estimate resides between the 25% and 5% viability curves (Figure 6-7c). The lower bound of the adjusted standard error for both the productivity and abundance extend below the 25% risk level.

Spatial Structure and Diversity

The ICTRT has identified three major spawning areas (MaSAs) and no minor spawning areas (MiSAs) within the South Fork John Day steelhead population (Figure 6-7d). A natural barrier at Izee Falls limits distribution in the mainstem South Fork. Spawning is distributed broadly throughout the population boundaries including mainstem areas in the South Fork John Day River, Murderers Creek, Canyon Creek, as well as many tributaries. Spawners within the South Fork are primarily natural origin fish; however, outside ESU hatchery fish, primarily from Snake River stocks, are present in the South Fork population.

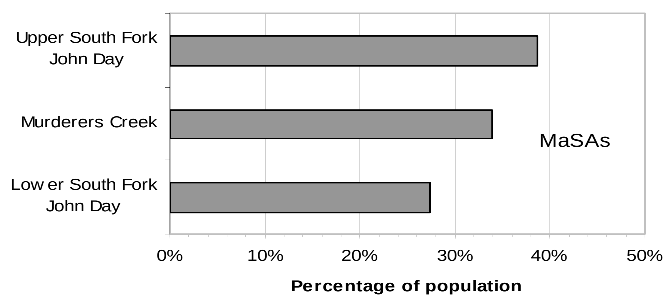


Figure 6-7d. Percentage of historical spawning habitat by major (no minor spawning aggregates present) spawning aggregates in the South Fork John Day River. There are no temperature limited portions in this population.

Factors and Metrics

<u>A.1.a. Number and spatial arrangement of spawning areas</u>.
The South Fork population has three MaSAs which are distributed in a dendritic pattern. Intrinsic potential is distributed relatively equal between the three MaSAs in the lower mainstem South Fork, Murderers Creek, and the upper South Fork. Based on the ODFW spawner distribution database all of the spawning reaches identified within the intrinsic potential distribution are currently occupied, and 247 Km of habitat are presently used for spawning (Figure 6-7e). The South Fork population rates at **low risk** for this metric because its three MaSAs are occupied.

A.l.b. Spatial extent or range of population

The current spawning distribution based on the ODFW distribution database mirrors the historical distribution represented by the intrinsic potential analyses. All MaSAs are currently occupied (Figure 6-7e). The South Fork population is rated **very low risk** for spatial extent and range criteria. Index area spawning surveys are conducted in five creeks, including at least one reach in each MaSA. Recent spawning ground surveys results will be analyzed for future viability assessments.

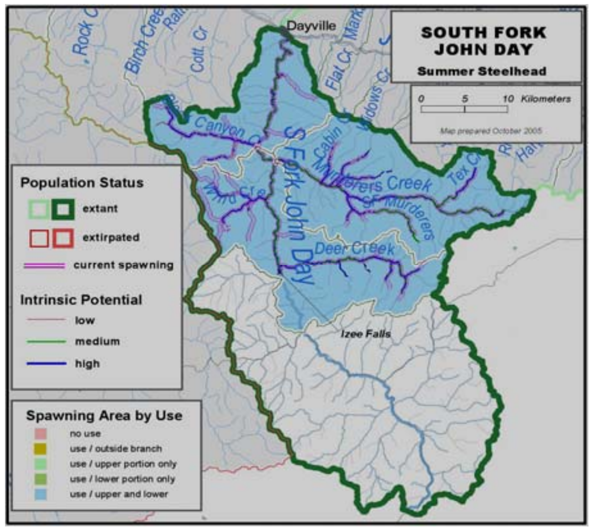


Figure 6-7e. South Fork John Day Steelhead distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.

There has been no increase or decrease in gaps between spawning areas. Spawning habitat connectivity appears to be unchanged within the South Fork population. The South Fork population rates at **very low risk** for gaps and connectivity.

B.1.a. Major life history strategies.

There are no direct observations to evaluate current life history strategies relative to historic, therefore we infer loss of life history diversity based on habitat changes. Increased water temperatures have likely reduced connectivity and quantity of habitats available during summer, but have not likely resulted in loss of any major life history strategies. Juvenile steelhead currently exhibit diverse patterns of movement to and from tributaries and mainstem reaches throughout the life cycle. These diverse movement patterns result in rearing in a diversity of habitat types. South Fork steelhead are Type-A with predominant smolt age-at-migration of age 2 and age 3 and return primarily after one or two years in the ocean. These characteristics are typical for summer run steelhead in the Columbia Basin. Evidence does not indicate loss of any major life history strategies, thus the population rates at **low risk** for this metric**.**

B.1.b. Phenotypic variation.

We have no data to assess if any phenotypic traits have been significantly changed or lost. Although habitat conditions are altered from historic conditions the types of alternations would not result in loss of significant phenotypic traits. Due to water temperature changes in the mainstem Columbia River and the John Day River, there have likely been reduction in variation of adult migration timing and some reduction in distribution of summer rearing. There are no other major selective pressures which would cause significant changes or loss of traits. The South Fork population rates at **low risk** for phenotypic variation.

B.1.c. Genetic variation.

There are limited genetics data for John Day steelhead populations and only one sample from the South Fork population. The South Fork population shows greater between population divergence than the other John Day samples. Overall, the John Day samples were not well differentiated. Samples were taken from a relatively small geographic area over a short timeframe. There is no biological basis for the low level of differentiation. Past genetic samples were likely taken prior to potential significant hatchery influence. For the genetic variation metric, we have assigned a level of **low risk** to the South Fork population. This rating reflects a balance between apparent similarity between populations in the John Day and some degree of differentiation. Samples were collected from multiple locations in 2005 and will be analyzed in the near future to better inform the genetic variation risk assessment.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. Inadequate data exist to estimate the out-of-ESU hatchery fraction specifically for the South Fork. Estimates we used in this assessment were based on data from a composite of four John Day populations (South Fork, Middle Fork, Upper John Day, and North Fork). These estimates are based on observations from spawning surveys and kelt collections. Since 1992 the estimate hatchery fraction has ranged from 0.01-0.13 with a mean of 0.067. Based on recovery of coded wire tagged fish from anglers, most of the strays are from Snake River hatcheries. Given the level and duration of strays, the population rated at **high risk** for this metric.

(2) *Out-of-MPG strays from within the ESU*. There have been a total of four coded wire tagged fish recovered in the John Day from out-of-MPG within ESU origin. Three originated from the Umatilla Hatchery program and one from the Deschutes. It appears very few within ESU hatchery fish stray into the John Day, thus the rating is **low risk**.

(3) *Out-of-population strays*. There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk**.

(4) *Within-population strays*. There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk**.

B.3.a. Distribution of population across habitat types.

The intrinsic potential distribution of the South Fork population encompassed five ecoregions with the John Day Clarno Uplands being predominant. The current distribution is nearly identical to the intrinsic distribution (Figure 6-7f and Table 6-7c), thus we have rated this population at **low risk** because only three of the ecoregions contain greater than 10% of the historic distribution.

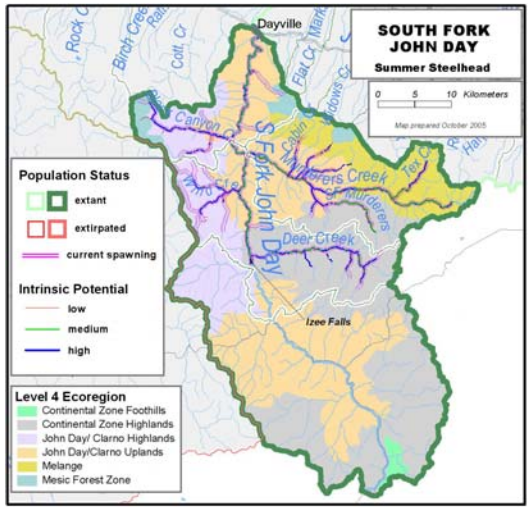


Figure 6-7f. South Fork John Day River Steelhead population distribution across various ecoregions

Table 6-7c. South Fork John Day River Steelhead—proportion of spawning area across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Continental Zone Highlands	22.4	20.1
John Day Clarno Highlands	8.8	8.4
John Day Clarno Uplands	55.5	59.0
Melange	13.0	12.1
Mesic Forest Zone	0.3	0.3

B.4.a. Selective change in natural processes or selective impacts.

Hydropower system: Although the hydrosystem and associated reservoirs likely pose some selective mortality on smolt outmigrants and adult migrants, the mortality would not appear to remove more than 25% of affected individuals. The likely impacts are rated as **low risk** for this metric.

Harvest: Recent harvest rates for group A steelhead are generally less than 10% annually. Although some harvest may be size selective for larger fish the selective mortality would not approach 25% of the larger fish, therefore the rating is **low risk** for this metric.

Hatcheries: No hatcheries are operated within this population. The rating is **very low risk** for this metric.

Habitat: There does not appear to be within-basin habitat changes which would pose any significant selective mortality on adult or juvenile life stages. The rating is **low risk** for this metric.

Spatial Structure and Diversity Summary

The integrated Spatial Structure/Diversity rating is low risk (Table 6-7d) for the South Fork John Day population. The rating for Goal A "allowing natural rates and levels of spatially mediated processes" rated midway between very low and low risk. Although the current spawner distribution mimics the intrinsic distribution, only three MaSAs exist within the population. Good continuity exists between spawning areas and gaps between areas have remained relatively unchanged.

The rating for Goal B "maintaining natural levels of variation" is low risk. As is the case for all John Day steelhead populations there is uncertainty in ratings of metrics "genetic variation" and "proportion of spawners that are out-of-ESU strays." We have limited genetics data for South Fork steelhead to determine if the current population variation is similar to historic conditions and to examine the degree of hatchery fish introgression. The metric for proportion of out-of-ESU strays rated as high risk. However, the analyses relied on composite data from four John Day populations. Additional population specific spawner composition data is needed to better inform the risk rating and to reduce the associated uncertainty.

Table 6-7d. Spatial structure and diversity scoring table

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	L (1)	L (1)	Mean=(1.5) Very Low Risk	Very Low Risk (1.5)	**Low Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	VL (2)	VL (2)			
B.1.a	L (1)	L (1)	Low (1)	Mean=(0.5) Low Risk	
B.1.b	VL (2)	VL (2)			
B.1.c	L (1)	L (1)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	L (1)				
B.2.a(3)	VL (2)				
B.2.a(4)	VL (2)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The South Fork John Day steelhead population does not currently meet the ICTRT recommended viability criteria (Figure 6-7g). The recent 10-year geometric mean abundance of 259 is only 52% of the minimum goal of 500. The 20-year delimited recruit per spawner point estimate resides above the minimum value required at a 500 abundance level, however the lower end of the adjusted standard error is below the 25% risk level. Increased productivity in combination with abundance will allow this population to achieve viable status as the Spatial Structure/Diversity criteria achieved a low risk rating. Although the population received a Spatial Structure/Diversity rating of low risk, there is considerable uncertainty surrounding the spawner composition data. Enhanced monitoring of the hatchery-wild ratios on the South Fork spawning grounds should be conducted to improve the hatchery fraction estimate and reduce the degree of uncertainty.

Spatial Structure/Diversity Risk

Abundance/Productivity Risk	Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	
Low (<5%)	V	V	MV	
Moderate (6-25%)		So Fork JD		
High >(25%)				

Figure 6-7g. Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV= Minimally Viable.

South Fork John Day Steelhead – Data Summary

Data type: Redd count expansions
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 6-7e. South Fork John Day Steelhead run data (used for curve fits and R/S analysis). Entries where the spawner is less than the median escapement (1979-1998) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	adj R/S
1979	**214**	**1.00**	**214**	**819**	**3.83**	**1.94**	**1588**	**7.43**
1980	**451**	**1.00**	**451**	**1058**	**2.34**	**0.50**	**534**	**1.18**
1981	467	1.00	467	1316	2.82	0.68	899	1.92
1982	824	1.00	824	1546	1.87	0.46	706	0.86
1983	821	1.00	821	1782	2.17	0.52	933	1.14
1984	687	1.00	687	1025	1.49	0.65	663	0.96
1985	1423	1.00	1423	290	0.20	0.46	133	0.09
1986	1069	1.00	1069	345	0.32	0.94	326	0.30
1987	1947	1.00	1947	399	0.20	2.18	868	0.45
1988	1958	1.00	1958	429	0.22	0.99	425	0.22
1989	**239**	**1.00**	**239**	**417**	**1.74**	**0.96**	**401**	**1.67**
1990	**332**	**1.00**	**332**	**325**	**0.98**	**2.83**	**920**	**2.77**
1991	**331**	**1.00**	**331**	**154**	**0.46**	**2.33**	**359**	**1.08**
1992	480	0.99	473	150	0.31	1.88	281	0.59
1993	**372**	**0.99**	**367**	**138**	**0.37**	**1.18**	**163**	**0.44**
1994	536	0.97	522	123	0.23	1.07	131	0.24
1995	**180**	**0.94**	**168**	**217**	**1.21**	**1.23**	**266**	**1.48**
1996	**145**	**0.93**	**135**	**436**	**3.01**	**1.03**	**450**	**3.10**
1997	**182**	**0.95**	**173**	**676**	**3.71**	**0.76**	**516**	**2.84**
1998	**115**	**0.96**	**110**	**719**	**6.28**	**0.49**	**353**	**3.08**
1999	105	0.98	103					
2000	288	0.91	263					
2001	576	0.91	525					
2002	922	0.90	830					
2003	761	0.89	679					
2004	452	0.87	393					
2005	197	0.87	172					

Table 6-7f. Geomean abundance and productivity estimates. Current abundance and productivity values are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	1.72	1.66	1.95	2.06	0.96	1.14	259
Std. Err.	0.30	0.33	0.25	0.27	0.26	0.25	0.24
count	10	9	10	9	12	20	10

Table 6-7g. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.99	0.25	n/a	n/a	0.68	0.68	66.0	0.97	0.23	n/a	n/a	0.90	0.45	63.9
Const. Rec	453	82	n/a	n/a	n/a	n/a	53.0	445	66	n/a	n/a	n/a	n/a	44.8
Bev-Holt	50	0	466	0	0.18	0.85	55.8	50	233	457	89	0.37	0.40	47.6
Hock-Stk	3.99	0.13	113.60	0.72	0.18	0.85	55.8	3.09	1.42	146	71	0.36	0.41	47.5
Ricker	2.34	0.68	0.00134	0.00035	0.26	0.80	57.7	2.37	0.60	0.00140	0.00030	0.47	0.38	52.1

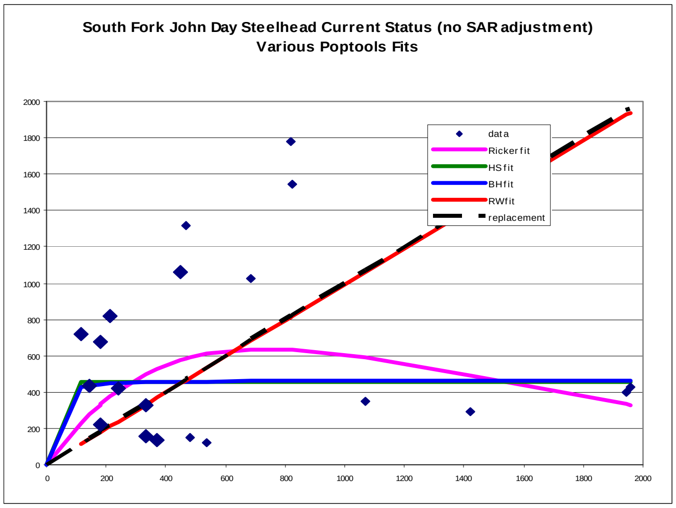


Figure 2h. Stock recruitment curves for the South Fork John Day River population. Data not adjusted for marine survival.

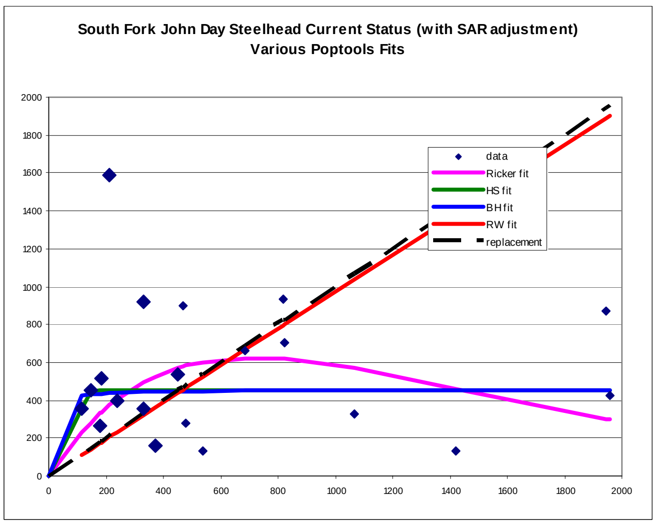


Figure 1h. Stock-recruitment curves for the South Fork John Day River population. Data adjusted for marine survival.

6.1.8 Upper John Day River Steelhead Population

The Upper John Day River steelhead population (Figure 6-8a) is part of the Mid-Columbia Steelhead ESU which has four major population groupings (MPGs), including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers and the Yakima River group. The ESU contains three life history categories: summer, winter, and summer-winter combination. The Upper John Day population is a summer run and resides in the John Day River MPG.

The ICTRT classified the Upper John Day River population as an "Intermediate" sized population (Table 6-8a). A steelhead population classified as intermediate has a minimum abundance threshold of 1,000 natural spawners with sufficient intrinsic productivity (greater than 1.4 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk of extinction in 100 years.

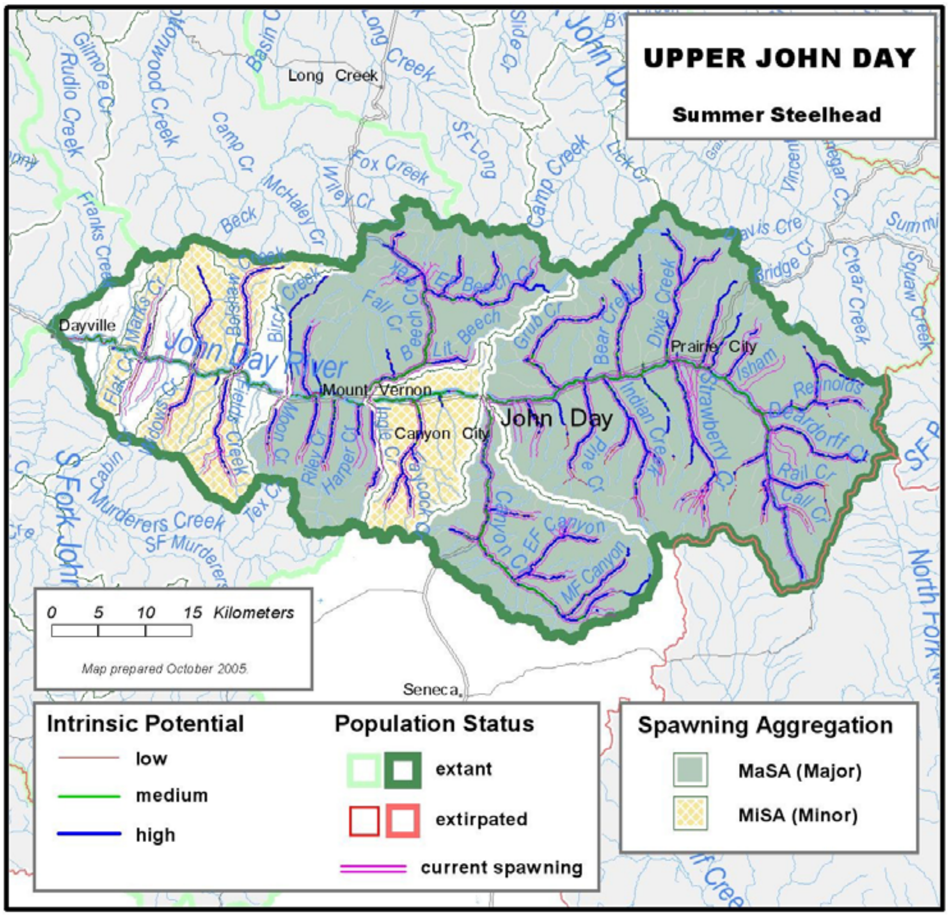


Figure 6-8a. Upper John Day River Steelhead population boundaries and major and minor spawning areas.

Table 6-8a. Upper John Day River Steelhead basin statistics.

Drainage Area (km2)	2,511
Stream lengths km* (total)	801
Stream lengths km* (below natural barriers)	767
Branched stream area weighted by intrinsic potential (km2)	2.532
Branched stream area km2 (weighted and temp. limited)	2.532
Total stream area weighted by intrinsic potential (km2)	3.260
Total stream area weighted by intrinsic potential (km2) temp limited	3.260
Size / Complexity category	Intermediate / B (dendritic structure)
Number of MaSAs	3
Number of MiSAs	4

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22ºC.

Current Abundance and Productivity

Current (1965 to 2005) abundance (number of adult spawners in natural production areas) has ranged from 197 (1995) to 4,235 (1988) (Figure 6-8b). Abundance estimates are based on expanded redd counts. ODFW, John Day district, index surveys of steelhead redds were used for the historical data set. We used index surveys that showed relatively consistent visitation through years. Survey data from Belshaw, Bear, Beech, East Fork Beech, Canyon, Middle Fork Canyon, McClellan, Riley, and Tinker creeks were used in the analysis. The current spawning distribution was used for the miles of available habitat within each population's range. The index redd densities were then multiplied by a correction factor to estimate the annual redd densities for the entire spawning distribution, based on the ratio of index redd densities to EMAP redd densities for 2004-05. This ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (.355x index density) was multiplied by the total miles of spawning habitat currently utilized. Total annual redds were converted to fish by multiplying total annual redds by fish per redd. Fish per redd ratios were developed from survey data on Deer Creek in the Grande Ronde Basin. The ratio is an average from four years of data of complete and repeated surveys (census) of redds above a weir where there was a complete fish count. The average fish per redd estimate from Deer Creek was 2.1.

The hatchery/wild composition of spawners was computed for the Lower Mainstem separately, and combined for all other populations. Data used to represent the Upper Mainstem included observations of positively identified adipose fin-clipped spawners (1992-present) from spawning survey observations in the four populations above the Lower Mainstem, and observations from rotary screw trap and seine collections of adults (2000-present). There is evidence from the Deschutes River that hatchery straying was substantially lower before 1992, and because the source of strays in the John Day Subbasin is the same as the Deschutes we assumed a similar trend. No other data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled fish collected during the 1980s. All samples were unmarked fish from locations above Tumwater Falls. Recent year natural spawners include returns originating from naturally spawning parents, and a small fraction of strays from the Snake River and Columbia River hatchery programs. Spawners originating from naturally spawning parents have comprised an average of 93% since hatchery strays were documented in 1992. Since then, the percentage of natural spawners has ranged from 87% to 99%.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 524 (572 total spawners). During the period 1969-1998, returns per spawner for steelhead in the Upper John Day River ranged from 0.19 (1992) to 5.43 (1979). The most recent 20-year (1979-1998) SAR adjusted, median delimited geometric mean of returns per spawner was 1.73 (Table 6-8b).

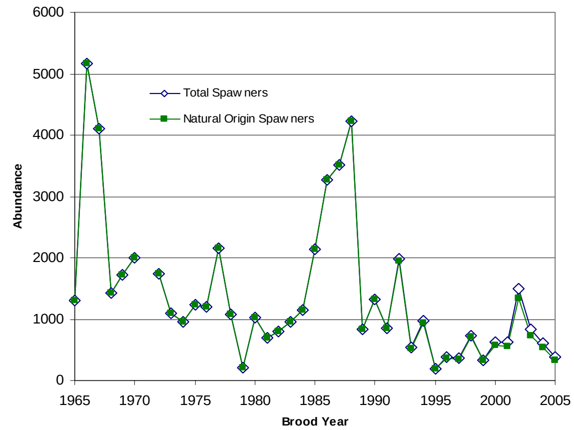


Figure 6-8b. Upper John Day abundance estimates 1965-2005. Estimates based on redd count expansions

Table 6-8b. Upper John Day River abundance and productivity measures

10-year geomean natural abundance	524
20-year return/spawner productivity	1.07
20-year return/spawner productivity, SAR adj. and delimited* at the median	1.73
20-year Bev-Holt fit productivity, SAR adjusted	n/a
Lambda productivity estimate	1.01
Average proportion natural origin spawners (recent 10 years)	93%
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds the median. This approach attempts to remove density dependence effects that may influence the productivity estimate.

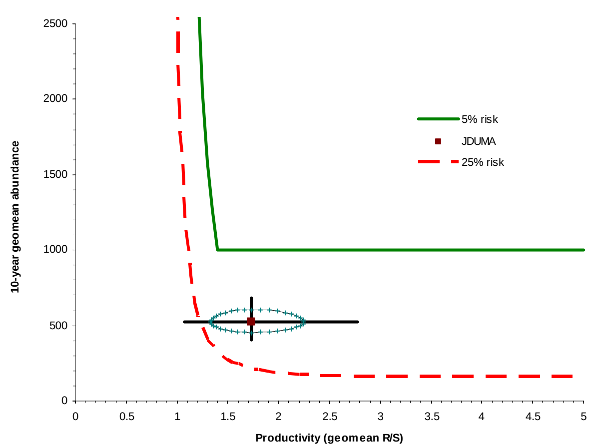


Figure 6-8c. Upper John Day River Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Estimate shown with a 1 SE ellipse, 1.81 X SE abundance line, and 1.81 X SE productivity line.

Comparison to the Viability Curve

- Abundance: 10-year geomean natural origin spawners
- Productivity: 20-year geomean R/S (adjusted for marine survival and delimited at 909 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Upper John Day River population is at MODERATE risk based on current abundance and productivity. The point estimate for abundance and productivity resides between the 5% and 25% risk curves. The adjusted standard error for productivity is below the 25% risk level (Figure 6-8c).

Spatial Structure and Diversity

The ICTRT has identified three major spawning areas (MaSAs) and four minor spawning areas (MiSAs) within the Upper John Day River steelhead population (Figure 6-8d). Most of the production area resides in the Upper John Day MaSA. Spawning is distributed broadly across the population including mainstem reaches in the Upper John Day River, Canyon Creek, and Beech Creek as well as in numerous tributaries from Dayville upstream to the headwaters. Spawners within the Upper John Day are primarily natural fish, although a small proportion of outside ESU hatchery fish, primarily from Snake River stocks, are present in the Upper John Day River population.

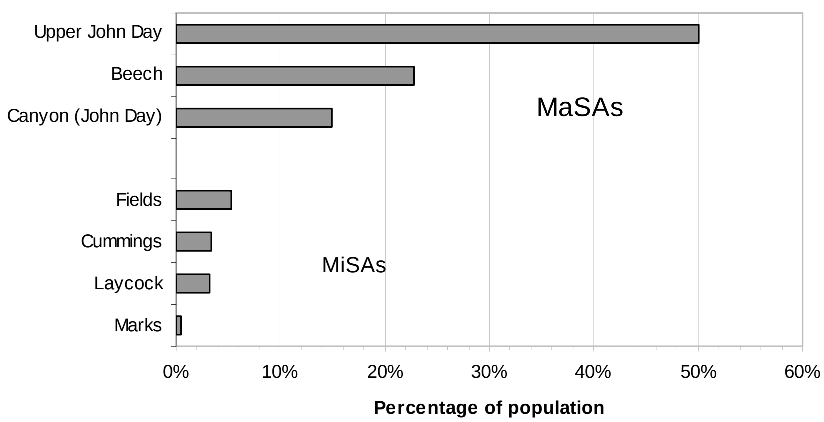


Figure 6-8d. Percentage of historical spawning habitat by major (no minor spawning aggregates present) spawning aggregates in the Upper John Day River. There are no temperature limited portions in this population.

Factors and Metrics

<u>A.1.a. Number and spatial arrangement of spawning areas</u>.

The Upper John Day population has three MaSAs and four MiSAs which are distributed in a complex dendritic pattern. Based on the ODFW spawner distribution database all of the MaSAs and MiSAs are currently occupied, and a total of 489 km are presently used for spawning (Figure 6-8e). The Upper John Day population rates at **very low risk** because three MaSAs and four MiSAs (which equal to greater than 75% of one MaSA area) are occupied in a dendritic configuration.

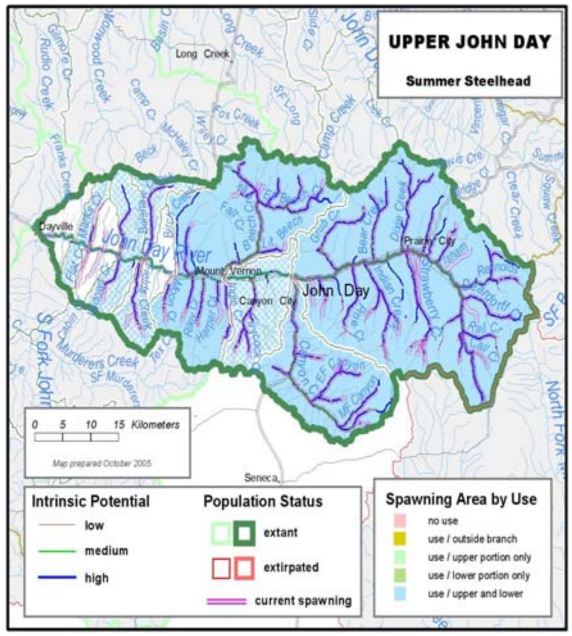


Figure 6-8e. Upper John Day Steelhead distribution

A.l.b. Spatial extent or range of population.

The current spawner distribution mirrors the historical intrinsic distribution. All MaSAs and MiSAs are currently occupied (Figure 6-8e). This population rates at **very low risk** for spatial extent and range. There are nine spawning survey index sites in the Upper John Day population covering all three MaSAs and one MiSA. Recent survey results will be analyzed for future viability assessments.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.

There have been no increases or decreases in gaps between spawning areas relative to intrinsic distribution. Spawning habitat connectivity appears to be unchanged within the Upper John Day population. This population rates at **very low risk** for this metric.

B.1.a. Major life history strategies.

There are no direct observations to assess loss in major life history strategies for the Upper John Day population, therefore we infer changes in life history from habitat information. Habitat conditions have been altered resulting in decreased flows and increased temperatures. The habitat changes limit juvenile movement patterns and rearing distribution during summer. The age-at-migration and ocean residence data are based on scale analyses from angler caught fish and represent a composite for John Day populations. Smolt age at migration and ocean residence appear to be normal for Type-A steelhead. There is no evidence for loss of major life history pathways. We have rated this metric as **moderate risk** because of the significant loss of summer rearing in the upper mainstem and tributaries.

B.1.b. Phenotypic variation.

Mainstem Columbia River temperatures, as well as temperatures within the John Day Basin, have likely reduced the variation in both adult and juvenile migration. Warmer temperatures in the summer and fall slow or prevent adult movement upstream into the John Day River. Warmer temperatures in early summer have likely truncated the smolt migration timing so that fewer fish migrate at the tail end of the distribution. The reduction in these phenotypic traits results in a rating of **low risk** for the Upper John Day population.

B.1.c. Genetic variation.
There are limited genetics data for the John Day steelhead populations and only one sample from the Upper John Day. We have no indications of past bottlenecks and the only major genetics concern is related to introgression from out-of-ESU hatchery fish. Overall the John Day samples are not well differentiated. Samples were taken from a relatively small geographic area for only one year. We have rated the population as **low risk**. This rating is driven by balance between apparent similarity within and between populations and relative degree of differentiation. There is the need for better genetic assessment of this population to characterize genetic diversity and hatchery fish genetic introgression. Samples were collected in 2005 to provide better information for assessing genetic variation.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. Inadequate data exists to estimate the out-of-ESU hatchery fraction specifically for the Upper John Day population. Estimates we used in this assessment are based on data from a composite of the four populations (South Fork, Middle Fork, Upper John Day, North Fork) in the John Day that are above the Lower John Day population. These estimates are based on observations from spawning surveys and kelt collections seined from the mainstem. Since 1992, the estimated hatchery fraction ranged from 0.01-0.13. The mean hatchery fraction was 0.067. Based on recovery of coded wire tagged hatchery fish, primarily from angler caught fish, the majority of stray hatchery fish originate from Snake River hatcheries. Given that the hatchery fraction of out-of-ESU strays is estimated to be greater than 0.05 for two or more generations, the risk rating is **high** for this metric.

(2) *Out-of-MPG strays from within the ESU*. There have been four coded wire tagged fish recovered in the John Day from out-of-MPG within ESU origin. Three originated from the Umatilla Hatchery program and one from the Deschutes. It appears very few within ESU hatchery fish stray into the John Day, thus the rating is **low risk** for this metric.

(3) *Out-of-population within MPG strays*. There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk.**

(4) *Within-population hatchery spawners.* There are no steelhead hatchery programs operated within the John Day Basin, therefore this metric is rated as **very low risk**.

B.3.a. Distribution of population across habitat types.

The initial distribution of the Upper John Day population encompassed four ecoregions of which only three were greater than 10% of the distribution (Figure 6-8f). The John Day Clarno Uplands is the dominant ecoregion. There has been very little change in ecoregion distribution as the current distribution mimics the intrinsic potential (Table 6-8c). The risk level is **low** only because three ecoregions have proportions greater than 10%.

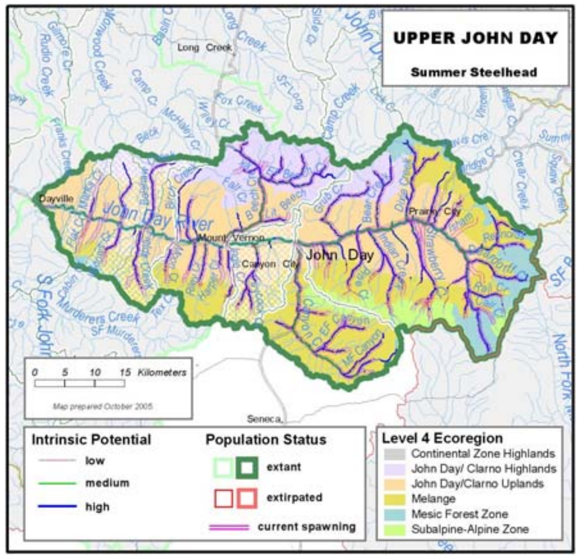


Figure 6-8f. Upper John Day River Steelhead population distribution across various ecoregions

Table 6-8c. Upper John Day River Steelhead– proportion of spawning area across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
John Day Clarno Highlands	13.8	12.7
John Day Clarno Uplands	50.7	51.4
Melange	30.5	31.0
Mesic Forest Zone	5.0	4.7
Subalpine-Alpine Zone	0.0	0.2

B.4.a. Selective change in natural processes or selective impacts.

Hydropower system: Although the hydrosystem and associated reservoirs likely pose some selective mortality on smolt outmigrants and adult migrants, the mortality would not appear to remove more than 25% of affected individuals. The likely impacts are rated as **low risk** for this metric.

Harvest: Recent harvest rates for group A steelhead are generally less than 10% annually. Although some harvest may be size selective for larger fish the selective mortality would not approach 25% of the larger fish, therefore the rating is **low risk** for this metric.

Hatcheries: No hatcheries are operated within this population. The rating is **very low risk** for this metric.

Habitat: The within basin habitat changes that have resulted in a significantly altered flow regime and increased temperature pose some selective mortality on juvenile life stages. We hypothesize that the selective mortality does not remove 25% of the affected individuals. The rating is **low risk** for this metric.

Spatial Structure and Diversity Summary

The integrated Spatial Structure/Diversity rating is moderate risk for the Upper John Day River population (Table 6-8d). The rating for Goal A "allowing natural rates and levels of spatially mediated processes" was very low. The current spawner distribution of the Upper John Day population mimics the intrinsic distribution and spawning occurs throughout the population boundaries with good continuity.

The rating for Goal B "maintaining natural levels of variation" was moderate risk. This risk rating was a result of a moderate rating for changes in major life history strategies. Additional genetics information needs to be assessed to determine current genetic variation and to examine for the degree of introgression of hatchery fish. The population was rated as high risk for out-of-ESU hatchery strays based on a limited time series of composite John Day population hatchery fish observation data. Better population specific spawner composition data are needed to better determine the out-of-ESU hatchery fraction. If there is significant hatchery introgression which affects the genetic variation of this population through time, then the risk rating for Goal B will increase, and the overall risk rating for Spatial Structure/Diversity will increase.

Table 6-8d. Spatial structure and diversity scoring table.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Mean=(2.0) Very Low Risk	Very Low Risk (2.0)	**Moderate Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	VL (2)	VL (2)			
B.1.a	M (0)	M (0)	Moderate (0)	Moderate Risk	
B.1.b	L (1)	L (1)			
B.1.c	L (1)	L (1)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	L (1)				
B.2.a(3)	VL (2)				

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
B.2.a(4)	VL (2)				
B.3.a	VL (2)	VL (2)	L (1)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The overall rating for the Upper John Day steelhead population does not currently meet the ICTRT recommended viability criteria (Figure 6-8g). The 10-year geomean abundance of 524 is well below the goal of 1,000. The productivity point estimate of 1.73 is near the minimum needed at an abundance of 1,000, however the lower end of the adjusted standard error is below the 25% risk level. Increases in productivity and abundance are needed for this population to achieve viable Abundance/Productivity criteria. In addition, the Spatial Structure/Diversity rating was moderate due to loss in life history diversity and high risk for spawner composition.

Spatial Structure/Diversity Risk

Abundance/ Productivity Risk	Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	
Low (<5%)	V	V	MV	
Moderate (6-25%)			Upper JD	
High >(25%)				

Figure 6-8g . Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV=Minimally Viable.

Upper John Day Steelhead – Data Summary

Data type: Redd count expansions
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 6-8e. Upper John Day Steelhead run data (used for curve fits and R/S analysis). Entries where the spawner number is less than the median escapement (1979-1998) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	adj R/S
1979	**215**	**1.00**	**215**	**1168**	**5.43**	**1.94**	**2265**	**10.53**
1980	1031	1.00	1031	1808	1.75	0.50	913	0.89
1981	**701**	**1.00**	**701**	**2790**	**3.98**	**0.68**	**1905**	**2.72**
1982	**801**	**1.00**	**801**	**3470**	**4.33**	**0.46**	**1586**	**1.98**
1983	964	1.00	964	3576	3.71	0.52	1873	1.94
1984	1150	1.00	1150	2419	2.10	0.65	1564	1.36
1985	2143	1.00	2143	1060	0.49	0.46	487	0.23
1986	3275	1.00	3275	1169	0.36	0.94	1102	0.34
1987	3520	1.00	3520	1315	0.37	2.18	2862	0.81
1988	4235	1.00	4235	1209	0.29	0.99	1198	0.28
1989	**839**	**1.00**	**839**	**680**	**0.81**	**0.96**	**654**	**0.78**
1990	1321	1.00	1321	545	0.41	2.83	1542	1.17
1991	**853**	**1.00**	**853**	**281**	**0.33**	**2.33**	**655**	**0.77**
1992	1979	0.99	1950	385	0.19	1.88	723	0.37
1993	**535**	**0.99**	**528**	**503**	**0.94**	**1.18**	**595**	**1.11**
1994	968	0.97	943	521	0.54	1.07	558	0.58
1995	**197**	**0.94**	**185**	**460**	**2.33**	**1.23**	**564**	**2.86**
1996	**387**	**0.93**	**361**	**641**	**1.66**	**1.03**	**662**	**1.71**
1997	**359**	**0.95**	**341**	**931**	**2.59**	**0.76**	**711**	**1.98**
1998	**736**	**0.96**	**704**	**993**	**1.35**	**0.49**	**487**	**0.66**
1999	333	0.98	326					
2000	622	0.91	567					
2001	619	0.91	564					
2002	1494	0.90	1344					
2003	828	0.89	738					
2004	617	0.87	536					
2005	375	0.87	326					

Table 6-8f. Geomean abundance and productivity estimates. Current abundance and productivity values are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	1.78	2.23	1.73	2.14	0.93	1.01	524
Std. Err.	0.28	0.23	0.26	0.33	0.13	0.19	0.15
count	10	7	10	7	12	20	10

Table 6-8g. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.07	0.24	n/a	n/a	0.54	0.69	62.1	1.05	0.21	n/a	n/a	0.76	0.24	57.1
Const. Rec	1000	160	n/a	n/a	n/a	n/a	48.1	981	120	n/a	n/a	n/a	n/a	37.2
Bev-Holt	9.20	12.17	1181	325	0.11	0.88	50.2	18.52	40.52	1063	228	0.27	0.27	39.8
Hock-Stk	3.56	1.80	291	155	0.11	0.88	50.3	4.58	0.56	215	0	0.26	0.32	39.7
Ricker	2.38	0.62	0.00061	0.00015	0.24	0.75	52.6	2.15	0.48	0.00055	0.00013	0.43	0.02	47.2

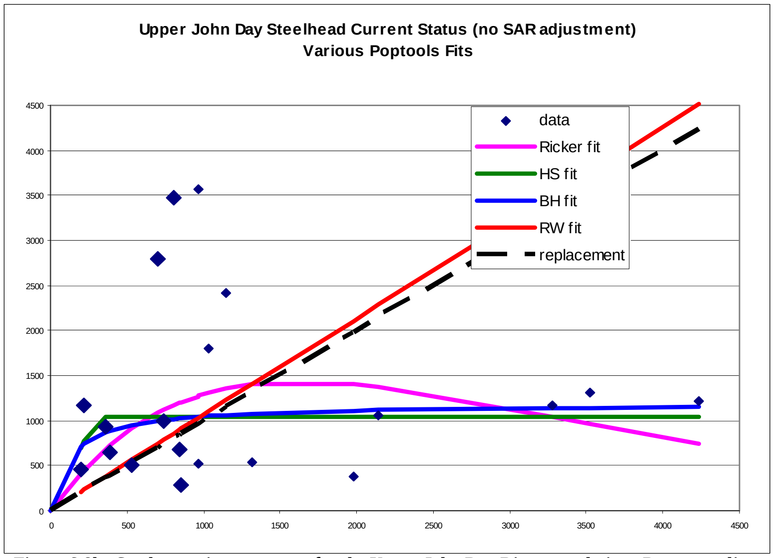


Figure 6-8h. Stock-recruitment curves for the Upper John Day River population. Data not adjusted for marine survival.

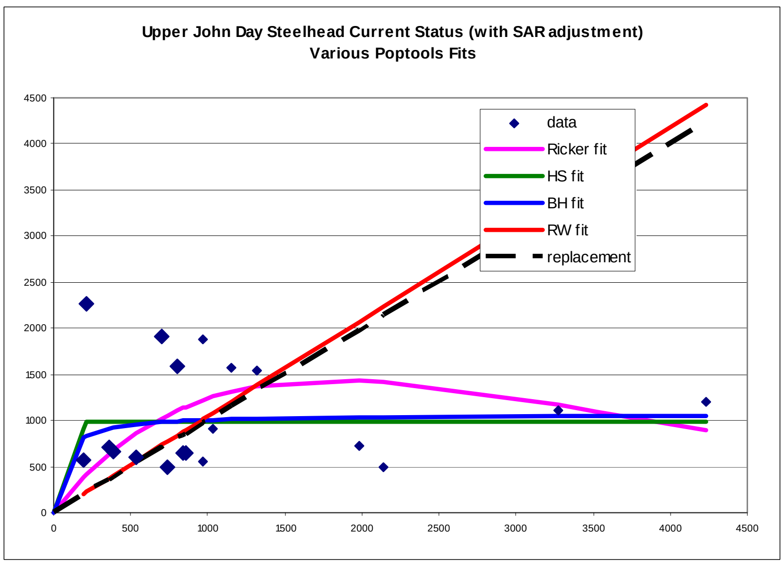


Figure 6-8i. Stock-recruitment curves for the Upper John Day River population. Data adjusted for marine survival.

6.1.9 Umatilla River Summer Steelhead Population

The Umatilla River steelhead population (Figure 6-9a) is part of the Mid-Columbia Steelhead ESU which has four major population groupings (MPG), including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers, and the Yakima River group. There are three life history categories in the ESU including: summer run, winter run, and summer-winter run combination. The Umatilla River population is a summer run and resides in the Umatilla/Walla Walla Rivers MPG along with the Walla Walla and Touchet populations.

The ICTRT classified the Umatilla River population as a “very large” sized population (Table 6-9a), although the “large” classification is used with respect to abundance and productivity metrics for this population because direct Columbia River tributaries in Washington areas outside the Umatilla Subbasin are included in the population boundaries. When these areas are factored out for the purposes of size classification and abundance/productivity criteria the Umatilla River population is classified as a large population. A steelhead population classified as large has a mean minimum abundance threshold of 1,500 with sufficient intrinsic productivity (greater than 1.3 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk of extinction over a 100-year timeframe.

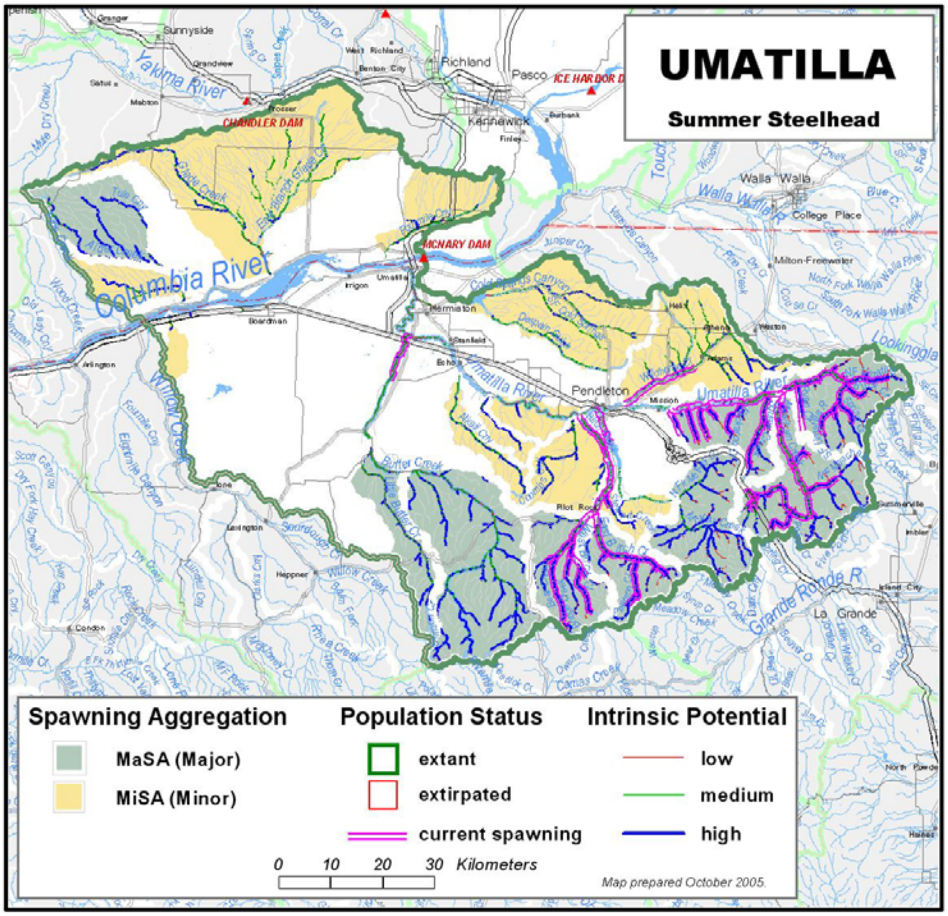


Figure 6-9a Umatilla Summer Steelhead population boundaries and major and minor spawning areas.

Table 6-9a. Umatilla River Summer Steelhead basin statistics.

Drainage Area (km2)	10,457
Stream lengths km[1] (total)	2,322
Stream lengths km[1] (below natural barriers)	2,278
Branched stream area weighted by intrinsic potential (km2)	5.644
Branched stream area km2 (weighted and temp. limited[2])	3.668
Total stream area weighted by intrinsic potential (km2)	8.134
Total stream area weighted by intrinsic potential (km2) temp limited[2]	4.110
Size / Complexity category	Very Large[3] / B (dendritic structure)
Number of MaSAs	9
Number of MiSAs	12

[1]All stream segments greater than or equal to 3.8m bankfull width were included

[2]Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22ºC.

[3]The Umatilla River Summer Steelhead population is considered to be "Very Large" for spatial structure and diversity metrics. For consideration of abundance and productivity metrics, however, it was moved to "Large" due to the size of the core area in the Umatilla Basin.

Current Abundance and Productivity

Current (1967 to 2004) total abundance (number of adult spawners in natural production areas) has ranged from 771 (1998) to 5,172 (2002) (Figure 6-9b). Spawner abundance estimates for natural and hatchery summer steelhead in the entire Umatilla River Basin were determined from complete counts of adult returns to Three Mile Falls Dam (TMFD) at river mile 3.7 minus removals or mortality at and above the dam in all years except brood years (BY) 1984-1987. Fish were enumerated using electronic counters from BY 1967-1983, trapping from BY 1988-2000, and a combination of trapping and video monitoring from BY 2001-present. For BYs 1984-1987 abundance estimates were made with mark-recapture estimates. Missing abundance data for BY 1971, 1972, and 1979 were reconstructed using the known mean brood age structure from BY 1991-1998 and all available counts of brood returns in years before and after the missing counts. Counts in BY 1976 and 1978 were also incomplete but not reconstructed. In these years, electronic counters only operated from Dec 24 – May 31 and Dec 13 – Mar 9, respectively. Age structure was determined by reading about 100-150 scales per year collected from adults returning in BY 1994-2004. Missing run year age structure data before BY 1994 was estimated as the BY 1994-2004 mean age structure.

Several sets of missing data for removals and mortalities at and above TMFD were estimated from the best available data. Missing harvest removals were estimated from creel survey data collected from the non-tribal fishery from BY 1993-2004 and the tribal fishery from BY 1993-2001. Harvest of hatchery fish from BY 1988-1992 was estimated as the mean percent harvest of the hatchery run passed above TMFD from the later time period (2.5% non-tribal and 6.4% tribal). All harvested fish were assumed to be natural origin before BY 1988. For years when harvest of natural fish was allowed in the non-tribal fishery (before BY 93), harvest was estimated as mean percent catch of the natural run passed above TMFD (6.8 %) (1993-2004) corrected by the mean percent of catch released (26%). Tribal harvest for BYs 1967-1987 of hatchery and natural steelhead was estimated as their respective mean percent harvest of their runs passed above TMFD (6.7% of the combined natural and hatchery run passed above TMFD). Missing broodstock removals in BY 1981 and 1982 were estimated as one natural fish collected for brood per 750 smolts produced based on the ratio of brood collected and smolts released in the early 1980's. All 95 hatchery fish collected for brood in BY 1991 were assumed to be coded-wire tagged and included in the total removal of 124 hatchery fish at TMFD for coded-wire tag recovery.

Recent year natural spawners include returns originating from naturally spawning parents, Umatilla River hatchery origin fish and out-of-ESU strays, primarily from the Snake River Basin. Natural origin fish have comprised an average of 73% of natural spawners since hatchery returns have been documented in 1988. Since that time, the percentage of natural origin spawners has ranged from 41% to 96%.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 1,472 (2,347 total spawners). During the period 1967-2000, returns per spawner for steelhead in the Umatilla River ranged from 0.3 (1978) to 4.98 (1998). The most recent 20-year (1981-2000) geometric mean of returns per spawner SAR adjusted and delimited at 75% of the threshold was 1.50 (Table 6-9b).

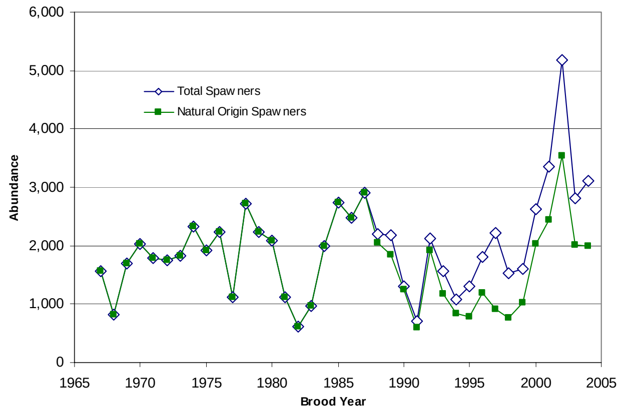


Figure 6-9b. Umatilla River abundance estimates 1967-2004. Estimates based on fish count expansions.

Table 6-9b. Umatilla Summer Steelhead abundance and productivity measures.

10-year geomean natural abundance	1472
20-year return/spawner productivity	0.94
20-year return/spawner productivity, SAR adj. and delimited*	1.50
20-year Bev-Holt fit productivity, SAR adjusted	n/a
Lambda productivity estimate	1.06
Average proportion natural origin spawners (recent 10 years)	0.73
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.

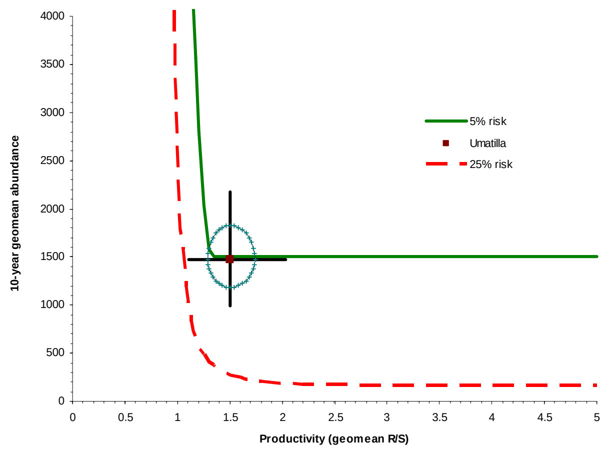


Figure 6-9c. Umatilla River Summer Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at 75% of the abundance threshold. Estimate shown with a 1 SE ellipse, 1.81 X SE abundance line, and 2.02 productivity line.

Comparison to the Viability Curve

- Abundance: 10-year geomean Natural Origin Returns
- Productivity: 20-yr geomean R/S (adjusted for marine survival and delimited at 1,125 spawners)
- Curve: Hockey-Stick curve
- Conclusion: Umatilla Summer Steelhead population is at MODERATE RISK. The productivity is at low risk because the point estimate is above 5% risk level and the adjusted standard error is above the 25% risk level. Abundance is moderate because the point estimate is slightly below the 5% risk level (Figure 6-9c).***Spatial Structure and Diversity***

The ICTRT has identified nine historic major spawning areas (MaSAs) and 12 minor spawning areas (MiSAs) within the Umatilla River steelhead population. In addition, one MaSA (Alder Creek) and one MiSA (Glade Creek) were included in the Umatilla River population that are actually direct tributaries to the Columbia River on the Washington side of the Columbia. We do consider these areas in the assessment of spatial structure/diversity for the Umatilla steelhead population (Figure 6-9d). Current spawning distribution is somewhat limited relative to historic and is concentrated in Birch Creek, Iskulpa Creek, Meacham Creek, Upper Umatilla River, and the North and South Forks of the Umatilla River. There is documented recent year spawning in both Glade Creek and Alder Creek subbasins (Yakama Indian Nation Fisheries Program, 2005).

Spawners within the Umatilla River population include natural origin returns, hatchery returns of Umatilla River origin broodstock, and hatchery strays, primarily originating from the Snake River Basin. Hatchery origin fish comprise a significant proportion of the natural spawning fish in most recent years.

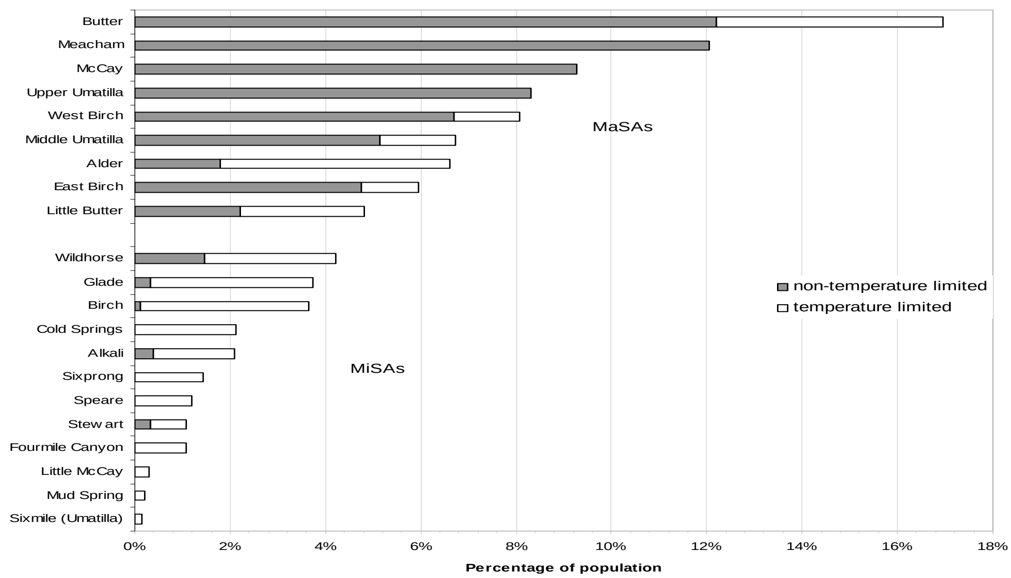


Figure 6-9d. Percentage of historical spawning habitat by major/minor spawning area. Temperature limited portions of each MiSA/MaSA are shown in white.

Factors and Metrics

<u>A.1.a. Number and spatial arrangement of spawning areas</u>.
The Umatilla River population has nine MaSAs and 12 MiSAs which are distributed in a complex dendritic pattern. Historically the major production areas included Butter Creek, Meacham Creek, McKay Creek, Iskulpa Creek, Birch Creek, and the middle and upper Umatilla River. Spawning distribution has been reduced significantly from the intrinsic historic distribution. Currently only six of the nine MaSAs are occupied. Little Butter Creek, Butter Creek, and McKay Creek MaSAs are unoccupied. Four of the 12 MiSAs are currently occupied including: Wildhorse, Stewart, Birch and Glade creeks. Although there has been a significant reduction in spawner distribution, the Umatilla population rates at **very low risk** because it has more than four occupied MaSAs in a dendritic configuration.

A.l.b. Spatial extent or range of population.

The current spawner distribution is reduced substantially from the intrinsic distribution. Based on the ODFW spawner database and WDFW information, six of nine (66.7%) MaSAs are currently occupied and only four of the 12 MiSAs are occupied (Figure 6-9e). The spatial extent and range of spawning distribution has been reduced to an extent that this population rates as **moderate risk** for this metric. There are 12 index area spawning survey sites in the Umatilla population. Recent survey results will be analyzed for use in future viability assessments.

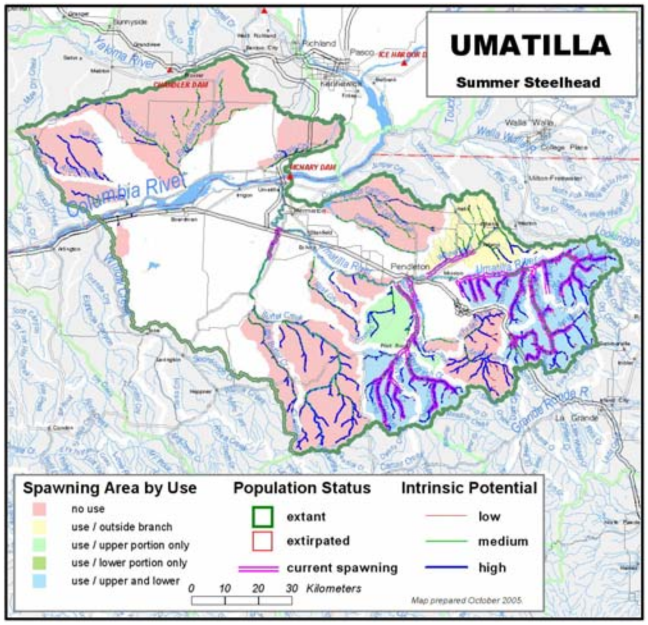


Figure 6-9e. Umatilla River Steelhead distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.

There has been a significant change in gaps and continuity as a result of the loss of spawning in the Butter and McKay creeks drainages. The loss of occupancy in Butter Creek has increased the gap between spawning areas in the lower and upper Umatilla Basin, as well as between the Umatilla population and other populations upstream. In addition, less that 75% of the intrinsic MaSAs are currently occupied, thus the rating is **moderate risk** for this metric.

B.1.a. Major life history strategies.

We have no data to allow any direct comparisons of historic and current life history strategies. Flow and temperature changes in the Umatilla Basin have limited movement patterns for both juvenile and adult steelhead. Juvenile steelhead cannot move into some mainstem rearing reaches above McKay Creek for over summer rearing due to high temperatures. Adults are unable to enter the Umatilla in early fall in many years because of the lack of flow as well as high water temperatures. Large areas, such as Butter and McKay creeks drainages, no longer support production. Flow enhancement projects have improved conditions for adult fall migration and summer rearing, particularly below McKay Creek. Past habitat changes have undoubtedly reduced diversity in life history pathways. However, it does not appear that any major pathways have been lost, and improved fall flows have provided conditions allowing adult migration throughout the fall season. Umatilla steelhead still exhibit a diverse age structure including multiple ages at smolt migration, multiple years of ocean residence and repeat spawning. The population rated at **moderate risk** because all pathways exist but there has been significant reduction in variability and changes in distribution.

B.1.b. Phenotypic variation.
We have no data to assess loss or substantial change is phenotypic traits, therefore we infer based on habitat changes. The changes in flow patterns and temperature profile within the Umatilla River and the mainstem Columbia River have likely resulted in reduced variation in adult and juvenile migration patterns. Juveniles have a much narrower window to successfully migrate out of the Umatilla in the spring because water temperatures increase earlier than historically. Even though flow enhancement has improved conditions for adult fall migration, the run-timing distribution is likely truncated from historic. Adults cannot enter the river in early fall in some years because of flow and temperature limitations. We have rated the Umatilla population at **moderate risk** because two or more phenotypic traits have changed.

B.1.c. Genetic variation.
The genetics data for Umatilla steelhead indicate that there is significant within population variation between Umatilla steelhead and other populations in the MPG (Touchet, Walla Walla). In addition, the within population diversity shows no indication of impairment. The hatchery fish are similar to natural fish as expected, since they are offspring of natural fish. There are out-of-ESU strays, primarily from Snake River stocks, spawning naturally in the Umatilla Basin. Given the degree of genetic variation the Umatilla population rated at **low risk** for this metric. Given that the genetics samples used in the analyses were collected from the mid-1980s, prior to significant hatchery influence, the genetic analyses needs to be updated with recent samples.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. A significant number of out-of-ESU strays enter the Umatilla River. Estimates of out-of-ESU strays are based on expanded coded wire tagged recoveries of hatchery fish at TMFD. From 1993-2004, out-of-ESU strays have comprised from 1.8-9.7% (mean=4.8%) of the fish that arrived at TMFD. These strays are not selectively removed because they are not distinguishable from Umatilla Hatchery supplementation steelhead. Given the length of time of influence and the hatchery fraction, we have rated the Umatilla population at **moderate risk** for out-of-ESU strays. This risk rating assumes strays were present at a similar rate for the past three generations.

(2) *Out-of-MPG strays*. There have been few, if any, out-of-MPG with ESU strays recovered in the Umatilla Basin, thus the rating is **very low** for this metric.

(3) *Out-of-population within MPG strays*. There are two out of population within MPG hatchery programs which could provide stray fish to the Umatilla River, Lyons Ferry releases in the Walla Walla, and Touchet River hatchery fish. No strays from these two programs have been observed. The rating is **very low** for this metric.

(4) *Within-population strays*. The Umatilla River population is supplemented annually with hatchery fish produced from wild broodstock collected at TMFD. The supplementation program has been ongoing since the late 1980's. Since 1993, Umatilla Hatchery fish have comprised an average of 29.4% of the natural spawning fish. We characterize this program as using best management practices based on the following:

- Most of the broodstock collected annually are wild fish.
- Mating protocols provide for a high number of family groups annually.
- There presently is no culling or grading of parr or smolts.
- Hatchery smolts are released in localized areas of the middle and upper mainstem.
- There does not appear to be any genetic differentiation between hatchery and natural fish.

Given that best practices are used, the average hatchery fraction is 29.4%, and the program has been underway for three generations, the rating is **moderate risk** for within population hatchery fish.

The overall risk rating for B.2.a. "spawner composition" is **high risk** because the out-of-ESU strays and within-population hatchery proportions were both rated as moderate.

B.3.a. Distribution of population across habitat types.

The intrinsic potential distribution encompassed seven ecoregions of which only three accounted for 10% or more of the distribution (Figure 6-9f). There has not been any significant shift in the ecoregion distribution. The Umatilla population has not lost more than 67% of proportional distribution in any ecoregion, thus it rates at **low risk**.

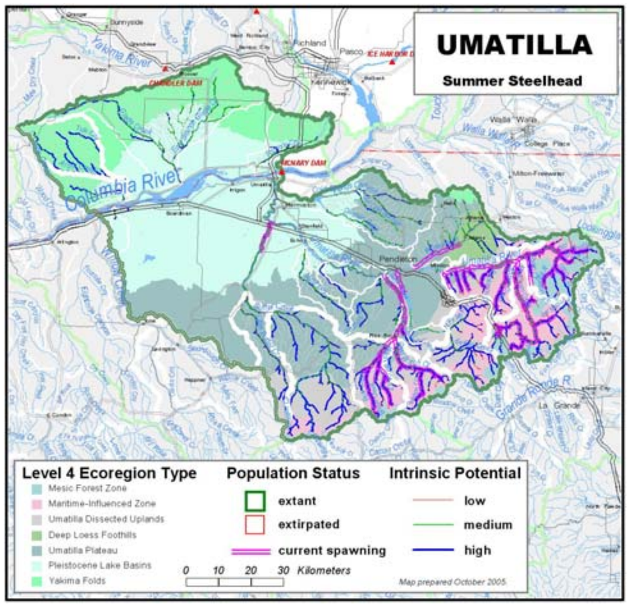


Figure 6-9f. Umatilla Summer Steelhead population distribution across various ecoregions.

Table 6-9c . Umatilla River Steelhead – proportion of spawning area across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Deep Loess Foothills	2.2	0.8
Maritime-Influenced Zone	27.6	47.2
Mesic Forest Zone	5.5	6.4
Pleistocene Lake Basins	6.0	4.3
Umatilla Dissected Uplands	24.2	22.1
Umatilla Plateau	25.7	19.1
Yakima Folds	8.8	0.0

<u>B.4.a. Selective change in natural processes or selective impacts.</u>

Hydropower system: The hydropower system and associated reservoirs impose some selective mortality on smolt outmigrants and upstream migrating adults. The magnitude of selective mortality and the proportion of population that is affected is unknown. The selective mortality is not likely to remove more than 25% of the affected individuals, thus this metric rated at **low risk**.

Harvest: Recent harvest rates for Type-A steelhead in the Columbia River Mainstem are generally less than 10% annually. Although some harvest may be size selective for larger fish, the selective mortality would not be near 25%. There is very limited tribal harvest of natural fish within the Umatilla Subbasin and impacts from the recreational fishery are incidental to hatchery fish harvest. There does not appear to be any selective mortality as a result of in-basin harvest. We rated this metric at **low risk**.

Hatcheries: The Umatilla River summer steelhead hatchery program is operated to provide hatchery fish for harvest and to supplement natural production. Broodstock are collected at TMFD. Typically 100 naturally produced and 20 hatchery fish are collected for broodstock. Broodstock are collected representatively so that their run-timing, sex, and age of broodstock mimic that of the total run at TMFD. We are uncertain of the degree of substructure within the basin or if there are different characteristics between spawning aggregates in the basin. If life history characteristics differ between different aggregates, there is the possibility that collection of broodstock representing TMFD timing may be differentially impacting spawning aggregates. However, the broodstock removal does not appear to represent a significant selective impact, thus we rated this metric at **low risk**.

Habitat: There are two habitat changes which likely impose some selective mortality, altered flow profiles, and increased temperatures. Mainstem summer temperatures are lethal in many reaches, and juveniles that leave tributary production areas and end up in the mainstem during summer likely suffer increased mortality. Late summer and early fall flows are often low in the Umatilla River and adults entering the river early are likely subject to unnatural mortality rates.

Although these mortality factors may not result in greater than 25% mortality of an individual component of the population, multiple life stages are affected and the effects have occurred for many generations. Thus we rated this metric at **moderate risk**.

Spatial Structure and Diversity Summary

The combined integrated Spatial Structure/Diversity rating is moderate risk (Table 6-9d) for the Umatilla River population. There has been significant reduction in spawner distribution relative to intrinsic potential distribution. This reduction has caused significant increases in gaps between spawning areas as well as disrupted continuity. Habitat changes have been significant in the Umatilla Basin resulting in changes to flow profiles and elevated temperatures. These changes have resulted in impacts to life history diversity and phenotypic trait variation. The out-of-ESU strays in combination with local origin hatchery fish spawning naturally put the population at high risk for spawner composition. Within basin habitat changes have likely resulted in selective mortality of specific components of juvenile and adult life stages resulting in a moderate risk rating.

Table 6-9d. Spatial structure and diversity scoring table.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	L (1)	L (1)	Mean=(0.33) Moderate Risk	Moderate Risk (0.33)	**Moderate Risk**
A.1.b	M (0)	M (0)			
A.1.c	M (0)	M (0)			
B.1.a	M (0)	M (0)	Moderate Risk (0)	Mean=( ) Moderate Risk	
B.1.b	M (0)	M (0)			
B.1.c	L (1)	L (1)			
B.2.a(1)	M (0)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	VL (2)				
B.2.a(3)	VL (2)				
B.2.a(4)	M (0)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	M (0)	M (0)	M (0)		

Overall Viability Rating

The Umatilla steelhead population does not currently meet the ICTRT recommended viability criteria because Abundance/Productivity and Spatial Structure/Diversity risks ratings are both moderate (Figure 6-9g). The 20-year delimited recruit per spawner point estimate is 1.50 with the lower end of the adjusted standard error above the 25% risk level, thus placing the productivity at low risk. The 10-year mean abundance of 1,472 is 98.1% of the minimum threshold of 1,500. Improvement in many of the Spatial Structure/Diversity metrics and a small increase in the average abundance will raise the population to viable status.

Spatial Structure/Diversity Risk

Abundance/ Productivity Risk	Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	
Low (<5%)	V	V	MV	
Moderate (6-25%)			Umatilla	
High >(25%)				

Figure 6-9g. Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV= Minimally Viable.

Umatilla River Steelhead – Data Summary

Data type: Dataset reconstructed from dam counts
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 6-9e. Umatilla River Steelhead run data (used for curve fits and R/S analysis). Entries where the spawners are less than 75% of the threshold are shown in bold.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1981	**1,115**	**1.00**	**1,115**	**2,635**	**2.36**	**0.68**	**1799**	**1.61**
1982	**609**	**1.00**	**609**	**2,640**	**4.33**	**0.46**	**1207**	**1.98**
1983	**974**	**1.00**	**974**	**2,525**	**2.59**	**0.52**	**1322**	**1.36**
1984	1,998	1.00	1,998	1,943	0.97	0.65	1257	0.63
1985	2,732	1.00	2,732	1,559	0.57	0.46	716	0.26
1986	2,487	1.00	2,487	1,017	0.41	0.94	959	0.39
1987	2,911	1.00	2,911	1,144	0.39	2.18	2490	0.86
1988	2,201	0.93	2,050	1,573	0.71	0.99	1558	0.71
1989	2,179	0.84	1,841	1,105	0.51	0.96	1062	0.49
1990	1,301	0.96	1,247	873	0.67	2.83	2471	1.90
1991	**700**	**0.85**	**592**	**593**	**0.85**	**2.33**	**1384**	**1.98**
1992	2,118	0.90	1,915	1,380	0.65	1.88	2594	1.22
1993	1,572	0.74	1,165	713	0.45	1.18	842	0.54
1994	**1,074**	**0.79**	**847**	**885**	**0.82**	**1.07**	**948**	**0.88**
1995	1,298	0.60	783	1,154	0.89	1.23	1414	1.09
1996	1,811	0.66	1,194	2,975	1.64	1.03	3070	1.70
1997	2,215	0.41	914	2,210	1.00	0.76	1687	0.76
1998	1,529	0.50	771	3,836	2.51	0.49	1880	1.23
1999	1,595	0.64	1,020	1,071	0.67	0.52	554	0.35
2000	2,621	0.77	2,030	2,584	0.99	1.00	2584	0.99
2001	3,353	0.73	2,444					
2002	5,172	0.68	3,542					
2003	2,822	0.71	2,015					
2004	3,109	0.64	2,003					

Table 6-9f. Geomean abundance and productivity estimates. Current abundance and productivity values are boxed.

delimited	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
	median	75% threshold	median	75% threshold	1989-2000	1981-2000	geomean
Point Est.	1.24	1.79	1.14	1.50	1.07	1.06	1472
Std. Err.	0.24	0.33	0.19	0.15	0.02	0.06	0.22
count	10	5	10	5	12	20	10

Table 6-9g. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

SR Model	Not adjusted for SAR							Adjusted for SAR						
	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.94	0.14	n/a	n/a	0.27	0.60	44.5	0.89	0.12	n/a	n/a	0.31	0.31	40.3
Const. Rec	1512	174	n/a	n/a	n/a	n/a	34.8	1438	147	n/a	n/a	n/a	n/a	30.2
Bev-Holt	22.07	116.06	1587	446	0.21	0.44	37.5	8.48	15.93	1625	425	0.20	-0.15	32.7
Hock-Stk	1.92	0.70	806	310	0.21	0.45	38.1	1.98	0.64	735	249	0.20	-0.18	32.8
Ricker	2.70	0.88	0.00060	0.00017	0.22	0.45	38.0	2.35	0.69	0.00055	0.00016	0.21	-0.14	33.4

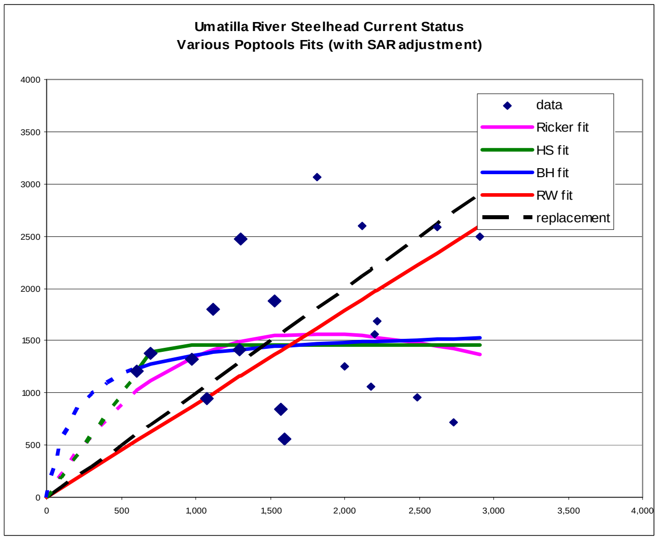


Figure 6-9h. Stock-recruitment curves for the Umatilla River Steelhead population. Data not adjusted for marine survival

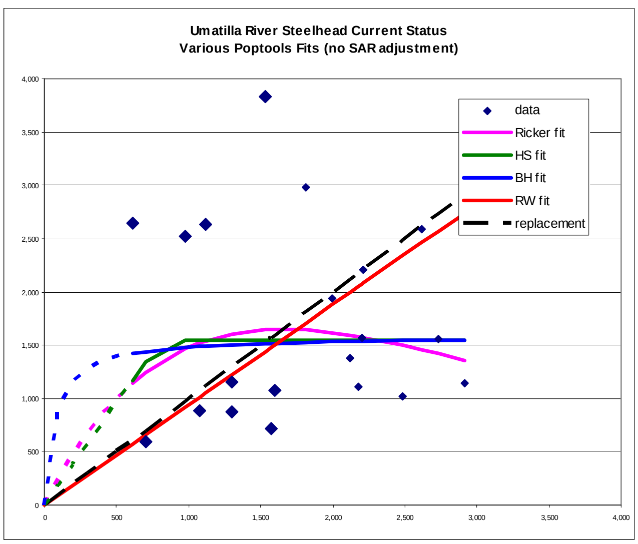


Figure 6-9i. Stock-recruitment curves for the Umatilla River Steelhead population. Data adjusted for marine survival

6.1.10 Walla Walla River Summer Steelhead Population

The Walla Walla River steelhead population (Figure 6-10a) is part of the Mid-Columbia Steelhead ESU which has four major population groupings (MPG), including: Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers and the Yakima River group. There are three life history diversity categories in the ESU: summer run, winter run, and summer-winter run combination. The Walla Walla River population is a summer run and resides in the Umatilla/Walla Walla rivers MPG along with the Touchet and Umatilla River populations.

The ICTRT classified the Walla Walla River population as an "Intermediate" sized population (Table 6-10a). A steelhead population classified as Intermediate has a mean minimum abundance threshold of 1,000 natural spawners with a sufficient intrinsic productivity (greater than 1.4 recruits per spawner at the threshold abundance level) to achieve a 5% or less risk of extinction over a 100-year timeframe.

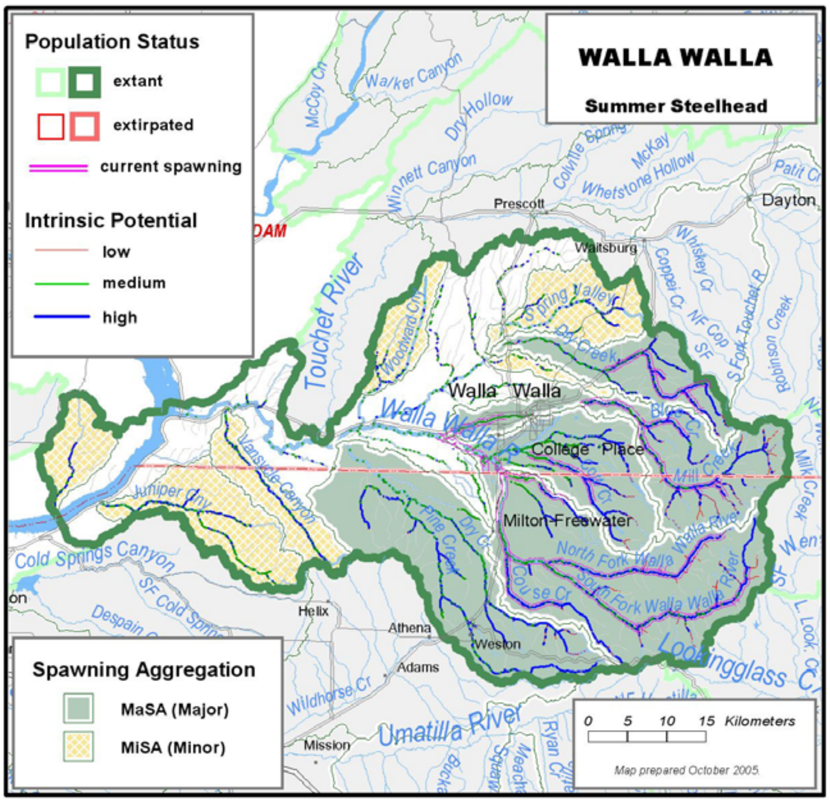


Figure 6-10a. Walla Walla Summer Steelhead population boundaries and major and minor spawning areas.

Table 6-10a. Walla Walla Summer Steelhead basin statistics.

Drainage Area (km2)	2,988
Stream lengths km* (total)	1,147
Stream lengths km* (below natural barriers)	1,111
Branched stream area weighted by intrinsic potential (km2)	2.730
Branched stream area km2 (weighted and temp. limited)	1.191
Total stream area weighted by intrinsic potential (km2)	3.539
Total stream area weighted by intrinsic potential (km2) temp limited	1.362
Size / Complexity category	Intermediate / B (dendritic)
Number of MaSAs	5
Number of MiSAs	6

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22ºC.

Current Abundance and Productivity

Current (1993 to 2003) total abundance (number of adult spawners in natural production areas) has ranged from 582 (1999) to 2506 (2002) (Figure 6-10b). Abundance of natural summer steelhead in the portion of the Walla Walla Basin above Nursery Bridge Dam (NBD) (North Fork, South Fork, and Couse Creek) was determined from counts of adult returns to NBD at river mile 44 minus removals or mortality at and above the dam. Fish were enumerated using trap counts and mark-recapture methods from brood years (BY) 1993-2001, and video counts in BY 2002, 2003, and 2005. Mark-recapture methods were used to account for fish that jumped the dam. Mark-recapture methods were discontinued following dam modifications that are thought to prevent fish from jumping the dam (pers. comm.: Tim Bailey, ODFW District Biologist, Pendleton). Almost all hatchery fish trapped at NBD were removed from BY 1993-1999. The BY 2003 count (547) was incomplete as the west side ladder was opened from February 21 through March 11 due to passage problems with the east side ladder. Fish passing through the west bank ladder were not counted. The number of uncounted fish in BY 2003 was estimated as the mean percent of run that passed NBD from Feb 21 - March 11 during BY 1993-2001 (12.3%). Percent of the run passing NBD during that time period ranged from 5.4 % to 18.7% from BY 1993-2001. Counts were not available for BY 2004 because video equipment was inoperable during most of the migration season. Missing abundance data for BY 2004 was reconstructed using mean brood age structure estimated from BY 1991-1998 data and all available counts of brood returns in years before and after the 2004 missing count. Age structure was determined by scale analyses from adults returning in 1993-1995. Missing run year age structure data following 1995 was estimated as the 1993-1995 mean age structure. Natural-hatchery origin could not be determined from video monitoring (2002-2005) and was estimated as the 1993-2001 mean percent of natural (96.4%) and hatchery (3.6%) origin fish in the run to NBD. Spawner abundance for the entire Walla Walla natural summer steelhead population was estimated by expanding abundance of spawners above NBD by a factor of 2.08. The expansion estimate was developed from the ratio of weighted intrinsic habitat potential for the currently occupied spawning area of the entire population divided by the weighted intrinsic habitat potential of occupied spawning area above NBD. Harvest removals were not factored into the estimate of spawning escapement above NBD. Tribal and non-tribal fishing pressure is thought to be minimal (pers. comm.: Tim Bailey, ODFW District Biologist, Pendleton). Recreational angling was prohibited from 1996-2002 and limited to retention of hatchery fish following 2002.

Recent years natural spawners include returns originating from naturally spawning adults and from outside-ESU strays which originate from Lyons Ferry Hatchery releases in the lower Walla Walla River. Natural origin fish have comprised an average of 98% over the 11 years of available data. Throughout the period, the percentage of natural origin fish has ranged from 95.4% to 99.8%.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 1,003 (1,023 for total spawners (Table 6-10b). During the period 1993-2003, returns per spawner for Steelhead in the Walla Walla River ranged from 0.24 (2001) to 3.46 (1997). The most recent 9-year (1993-2001) geometric mean of returns per spawner, delimited at the median and SAR adjusted was 1.40 (Table 6-10b).

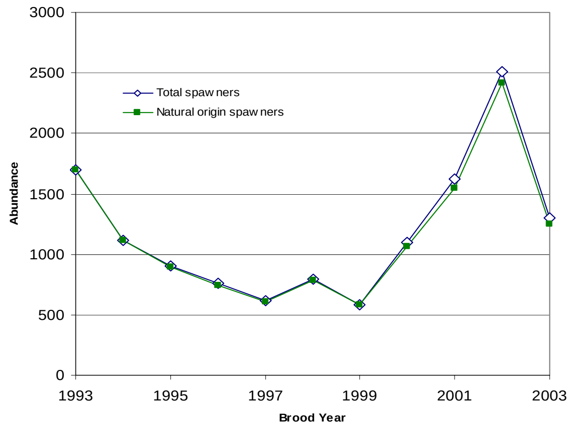


Figure 6-10b. Walla Walla Steelhead abundance estimates 1993-2003. Estimates based on expanded fish counts.

Table 6-10b. Walla Walla Summer Steelhead abundance and productivity measures.

10-year geomean natural abundance	1,003
9-year return/spawner productivity (ONLY 9 years available)	0.92
9-year return/spawner productivity, SAR adjusted and delimited*	1.40
20-year Bev-Holt fit productivity, SAR adjusted	n/a
Lambda productivity estimate	1.14
Average proportion natural origin spawners (recent 10 years)	0.98
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds the median population size. This approach attempts to remove density dependence effects that may influence the productivity estimate.

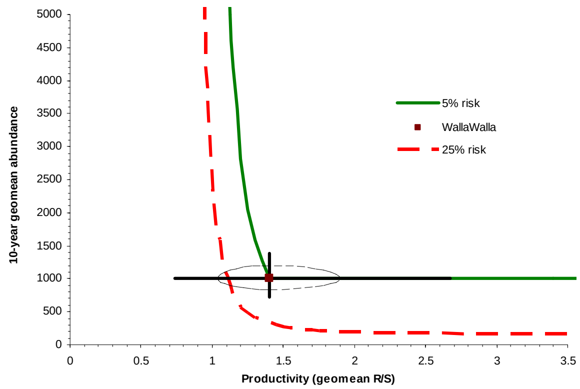


Figure 6-10c. Walla Walla Summer Steelhead abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Estimate shown with a 1 SE ellipse, 1.81 SE abundance line, and 2.13 SE productivity line.

Comparison to the Viability Curve

- Abundance: 10-year geomean Natural Origin Returns.
- Productivity: 9-year geomean R/S, adjusted for marine survival, and delimited at 904 spawners.
- Curve: Hockey-Stick curve
- Conclusion: Walla Walla Summer Steelhead population is at MODERATE RISK based on current abundance and productivity. The productivity point estimate is equal to the minimum required for low risk, however the adjusted standard error is below the 25% risk level. The abundance point estimate falls on the threshold and is considered low risk (Figure 6-10c).

The moderate risk rating is also supported by a couple of other considerations. First, the time series is short, with only nine brood years, and there is considerable uncertainty if the data adequately represent the true value. Second, there is considerable uncertainty associated with the amount of spawning and production that occurs within the population outside of the area above Nursery Bridge Dam, particularly in Mill Creek. Better information relating abundance above Nursery Bridge Dam to the remaining area in the population is needed to reduce this data uncertainty.

Spatial Structure and Diversity

The ICTRT has identified five historic major spawning areas (MaSAs) and six minor spawning areas (MiSAs) within the Walla Walla steelhead population (Figure 6-10d). Two small watersheds, which are classified as MiSAs and which empty directly into the Columbia River below the Walla Walla River confluence, are included in the Walla Walla population boundaries (Juniper Canyon, OR and Switzler, WA). Current spawning distribution is substantially reduced relative to the historic intrinsic distribution. Current production is concentrated in the North and South Fork Walla Walla River, Couse Creek, Mill Creek and Dry Creek (WA). Spawners within the Walla Walla population are primarily natural origin fish with a small proportion of hatchery strays which are Snake River origin fish produced at Lyons Ferry Hatchery and released into the lower Walla Walla River. Hatchery strays were removed at NBD by trapping until 1999. Trapping was discontinued after 1999 and replaced with video monitoring, and now stray hatchery fish pass above NBD to spawn naturally.

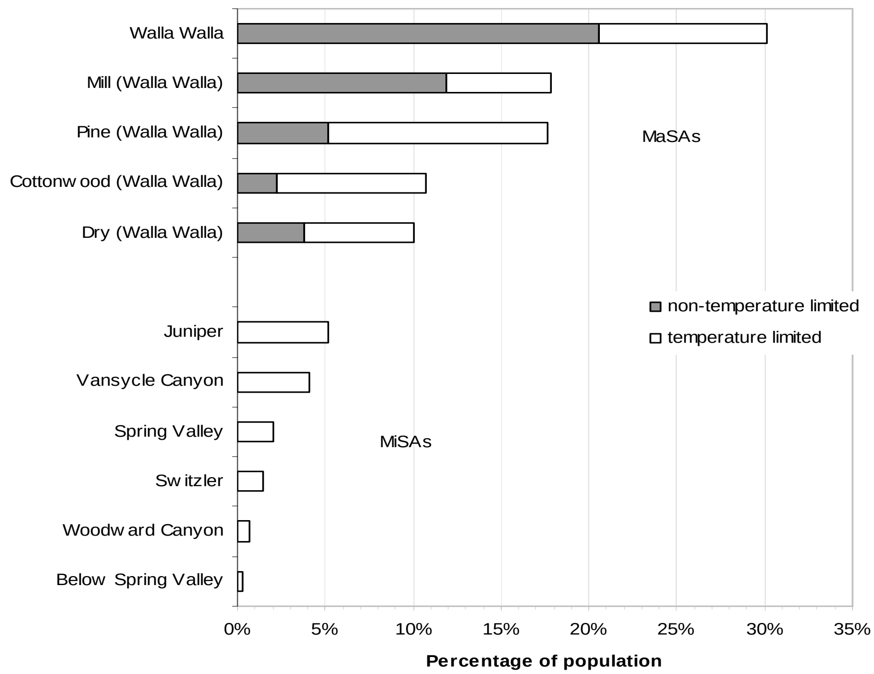


Figure 6-10d. Walla Walla Summer Steelhead percentage of historical spawning habitat by major/minor spawning area. Temperature limited portions of each MiSA/MaSA are shown in white.

Factors and Metrics

A.1.a Number and spatial arrangement of spawning areas.
The Walla Walla River population has five MaSAs and six MiSAs distributed in a dendritic pattern. Historically major production areas included Pine Creek, South Fork Walla Walla, North Fork Walla Walla, Mill Creek, Cottonwood Creek and Dry Creek in Washington. Spawning distribution has been reduced significantly relative to historic distribution. Currently four of five of the MaSAs are occupied, including Walla Walla, Mill, Cottonwood, and Dry. Spawning and rearing occur in the lower reaches of the Pine Creek MaSA. One of six of the MiSAs is occupied, Juniper Canyon. Even though there has been significant reduction in distribution the population rated at **very low risk** because it has four or more MaSAs occupied in a dendritic pattern.

A.l.b. Spatial extent or range of population.

Based on comparison of the ODFW and WDFW current spawner distribution databases and the intrinsic distribution, there has been substantial reduction in the range. Currently four of five MaSAs (80%) and one of six MiSAs (16.7%) are occupied (Figure 6-10e). Even though there has been significant reduction, the population is rated at **low risk** because more than 75% of the historical MaSAs are currently occupied. There are limited spawning survey data to evaluate occupancy for this population. The current spawning survey data will be analyzed for future viability assessments.

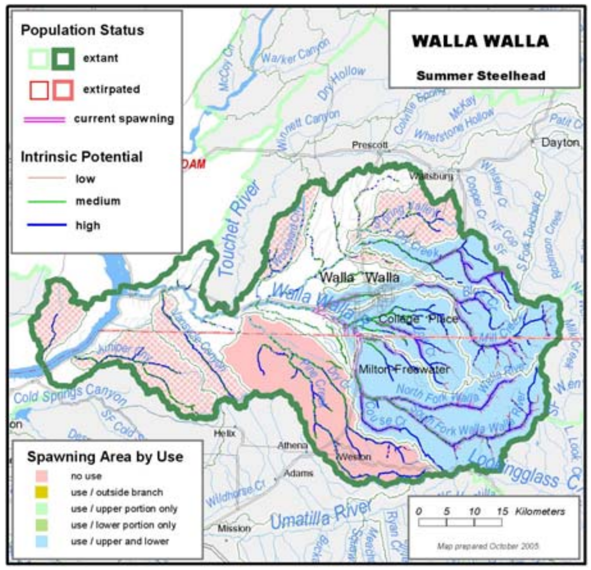


Figure 6-10e. Walla Walla River Summer Steelhead distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.

There have been minor changes in gaps and continuity as a result of loss of spawning in the upper reaches of the Pine Creek MaSA, and the Woodward and Vansycle MiSAs. The loss of occupancy in these areas has increased the gap in spawning areas between the Lower Walla Walla and Upper Walla Walla MaSAs, as well as increased the distance between the Walla Walla population and other Mid-Columbia steelhead populations. The Pine Creek MaSA has spawning in the lower reaches, and although this MaSA does not meet occupancy criteria it provides connectivity and reduces the risk rating from moderate to **low risk**.

B.1.a. Major life history strategies.

We have no data to allow any direct comparisons between historic and current life history strategies. Flow and temperature changes and barriers in the Walla Walla Basin have limited movement patterns of juvenile and adult steelhead during recent decades. Juvenile steelhead are unable to use many of the mainstem areas during the summer months due to high temperatures and low flows. Adults are unable, in some years, to enter the Walla Walla River in early fall. These types of changes have likely resulted in reduced life history diversity. However, it does not appear that any major life history pathways have been lost. The age structure and run-timing of adults is within the range observed for other summer steelhead populations. The population exhibits multiple ages of smolt outmigration and ocean residence time, as well as repeat spawners. The habitat changes have likely resulted in significant reduction in variability as well as a change in distribution of life history pathways, thus we have rated the population at **moderate risk** for this metric.

B.1.b. Phenotypic variation.
There are no data to assess loss or substantial change in phenotypic traits, therefore we infer from habitat changes. The changes in flow patterns and temperature profile within the Walla Walla River, as well as the affects of adult passage barriers, have likely resulted in reduced adult and juvenile phenotypic traits. Juveniles have narrower windows for successful outmigration through the Walla Walla River as well as through the Columbia River. Adults cannot enter and migrate through the Walla Walla during late summer and early fall in some years due to temperature limitations. The Walla Walla population rated at **moderate risk** because of likely change in mean and variability of two or more phenotypic traits.

B.1.c. Genetic variation.
The genetics information for the Walla Walla population demonstrates levels of within and between population differentiation that are healthy and do not indicate any substantial change from likely historical condition. In addition, there is no signal of significant introgression of outside-ESU hatchery fish. The population rated at **very low risk** for genetic variation.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. There are a number of out-of-ESU strays present in the population. Until 1999, stray hatchery fish were removed at Nursery Bridge Dam from the fish headed to the upper Walla Walla Basin. Since that time hatchery fish have passed upstream to spawn naturally. The removal of these out-of-basin strays had reduced the risk to the natural population. We estimated that about 2.0% of the natural spawners have been out-of-basin strays for recent generations. This estimate is based on the overall average of 4% at Nursery Bridge Dam for 1993-2001 and an estimate of about 50% of the population arriving at Nursery Bridge Dam. With 2% out-of-ESU strays for the past three generations the population is rated at **moderate risk**. It should be noted that the risk level will increase over time since the out-of-ESU strays are no longer removed at Nursery Bridge Dam.

(2) *Out-of-MPG strays*. There are no documented out-of-MPG within ESU strays in this population so the rating is **very low risk** for this metric.

(3) *Out-of-population strays*. There are no documented out-of-population within MPG strays, so the rating is **very low risk** for this metric. However, this risk rating may increase in the future with within population potential Touchet River hatchery strays.

(4) *Within-population strays*. There is no within population hatchery program, so the population is rated at **very low risk** for this metric.

B.3.a. Distribution of population across habitat types.

The intrinsic potential distribution of the Walla Walla population encompassed eight Level 4 ecoregions of which five accounted for 10% or more of the ecoregion distribution (Figure 6-10f). Within these five ecoregions there has been little change in the proportions from the historic intrinsic to the current distribution. The population is rated at **very low risk** because all historical ecoregions are occupied, there are more than four currently occupied, and there have been no substantial changes in ecoregion occupancy (Table 6-10c).

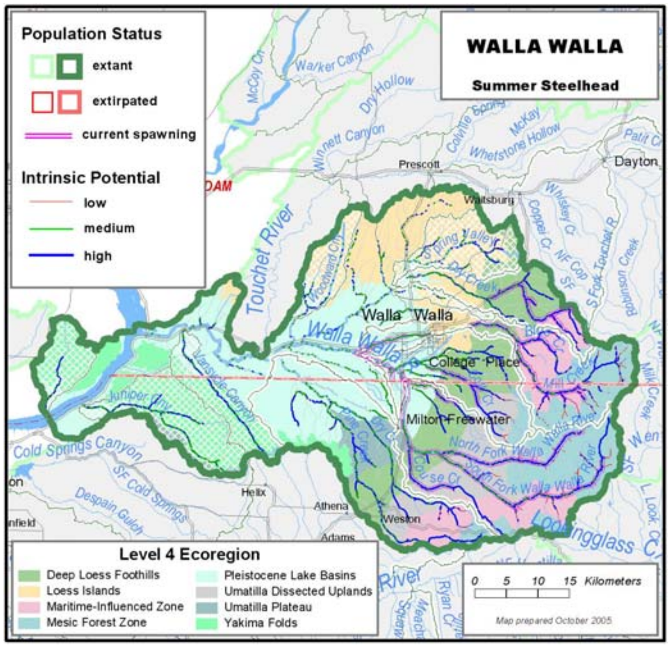


Figure 6-10f. Walla Walla River Summer Steelhead population distribution across various ecoregions.

Table 6-10c. Walla Walla River Summer Steelhead – proportion of spawning area across various ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Deep Loess Foothills	25.4	28.9
Loess Islands	5.9	0.9
Maritime-Influenced Zone	19.2	26.4
Mesic Forest Zone	11.0	12.5
Pleistocene Lake Basins	14.0	14.8
Umatilla Dissected Uplands	14.3	16.4
Umatilla Plateau	4.5	0.0
Yakima Folds	5.8	0.0

B.4.a. Selective change in natural processes or selective impacts.

Hydropower system: The hydrosystem and associated reservoirs pose some selective mortality on smolt outmigrants and upstream migrating adults. The magnitude of selective mortality and the proportion of the population affected have not been qualified. The selective mortality is not likely to remove more than 25% of the individuals, thus the population rated at **low risk** for this metric.

Harvest: Recent harvest rates for Group A steelhead in the Columbia River mainstem have been generally less than 10% annually. Although some harvest is likely size selective for larger fish the magnitude and duration of selective harvest would not selectively remove 25% of only the larger fish. There are minimal harvest impacts on natural fish from within basin recreational fisheries because the fisheries target hatchery fish and natural mortality is incidental. There does not appear to be any significant selective mortality due to harvest, thus the population rated at **low risk** for this metric.

Hatcheries: There is no within population hatchery program, thus no potential for selective mortality on natural fish. We have rated the population at **very low risk** for this metric.

Habitat: There is a number of habitat changes that have likely imposed significant selective mortality during the past four generations. Within basin dams have posed significant selective pressure on run-timing of adult fish and have likely prevented specific components of the run from reaching productive spawning areas in the Mill Creek watershed. Mainstem summer temperatures in some areas reach levels which would impose selective mortality on those fish which migrated from tributary production areas into the mainstem. Late summer and early fall low flows can prevent adults from entering the river and migrating upstream to overwinter areas. Although any single one of these mortality factors may not result in greater than 25% mortality of an individual population component, there are multiple life stages which are affected and the affects have occurred for many generations, thus the rating is **moderate risk** for this metric.

Spatial Structure and Diversity Summary

The integrated Spatial Structure/Diversity rating for the Walla Walla population is moderate risk (Table 6-10d). There has been significant reduction in spawner distribution which has resulted in increased gaps and loss of continuity within the population, as well as between the Walla Walla population and other Mid-Columbia steelhead populations. Water temperature and hydrograph changes as well as barriers have likely influenced life history diversity and phenotypic expression. Out-of-ESU strays have put the population in the moderate risk category for the spawner composition metric. Within basin habitat changes have likely resulted in selective mortality at multiple life stages resulting in a moderate risk rating.

Table 6-10d. Spatial structure and diversity scoring table.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Mean = 1.33 Low Risk	Low Risk	**Moderate Risk**
A.1.b	L (1)	L (1)			
A.1.c	L (1)	L (1)			
B.1.a	M (0)	M (0)	Moderate Risk (0)	Moderate Risk	
B.1.b	M (0)	M (0)			
B.1.c	VL (2)	VL (2)			
B.2.a(1)	M (0)	Moderate Risk (0)	Moderate Risk (0)		
B.2.a(2)	VL (2)				
B.2.a(3)	VL (2))				
B.2.a(4)	VL (2)				
B.3.a	VL (2)	VL (2)	VL (2)		
B.4.a	M (0)	M (0)	M (0)		

Overall Risk Rating

The Walla Walla steelhead population does not currently meet ICTRT recommended viability criteria (Table 6-10g). The abundance/productivity values are at moderate risk and the time series is short resulting in considerable uncertainty. We need additional broodyears to demonstrate sustained recruits per spawner and abundance values above the low risk criteria level. Significant improvements to spatial structure and diversity are needed to improve the risk level.

Spatial Structure/Diversity Risk

Abundance/ Productivity Risk	Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	
Low (<5%)	V	V	MV	
Moderate (6-25%)			Walla Walla	
High >(25%)				

Figure 6-10g. Abundance & productivity and spatial structure & diversity integration table. HV=Highly Viable; V=Viable; MV= Minimally Viable.

Walla Walla River Steelhead – Data Summary

Data type: Dataset reconstructed from dam counts
SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series
Productivity: ONLY 9 spawner/recruit pairs for this population exist, therefore results must be interpreted carefully.

Table 6-10e. Walla Walla River Steelhead run data (used for curve fits and R/S analysis). Entries where the spawner number is less than the median escapement (1993-2001) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1993	1699	99.8%	1695	726	0.43	1.18	858	0.51
1994	1115	99.8%	1113	689	0.62	1.07	737	0.66
1995	904	98.9%	894	1043	1.15	1.23	1278	1.41
1996	**760**	**98.0%**	**745**	**1562**	**2.06**	**1.03**	**1612**	**2.12**
1997	**617**	**98.4%**	**607**	**2100**	**3.40**	**0.76**	**1603**	**2.60**
1998	**792**	**99.2%**	**786**	**1497**	**1.89**	**0.49**	**734**	**0.93**
1999	**582**	**99.7%**	**580**	**856**	**1.47**	**0.52**	**443**	**0.76**
2000	1096	97.5%	1069	386	0.35	1.00	386	0.35
2001	1623	95.4%	1548	367	0.23	1.00	367	0.23
2002	2506	96.4%	2417					
2003	1298	96.5%	1252					

Table 6-10f. Geomean abundance and productivity estimates. Current abundance and productivity values are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1993-2001	1980-1999	geomean
Point Est.	2.10	2.24	1.40	1.41	1.14	n/a	1003
Std. Err.	0.18	0.42	0.30	0.61	0.01	n/a	0.18
count	4	2	4	2	9	n/a	10

Table 6-10g. Poptools stock-recruitment curve fit parameter estimates. Productivity values and standard errors determined to be out of bounds are highlighted.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.92	0.27	n/a	n/a	0.43	0.66	29.0	0.81	0.20	n/a	n/a	0.30	0.69	26.6
Const. Rec	878	167	n/a	n/a	0	1	21.5	771	140	n/a	n/a	0	1	20.7
Bev-Holt	50	138	893	180	0.16	0.72	26.4	50	192	784	154	0.13	0.76	25.5
Hock-Stk	1.71	19.68	512	5880	0.16	0.72	26.3	1.47	0.00	525	0	0.13	0.76	25.5
Ricker	6.85	2.78	0.00197	0.00037	0.15	0.40	21.1	3.65	1.75	0.0015	0.0004	0.15	0.65	24.1

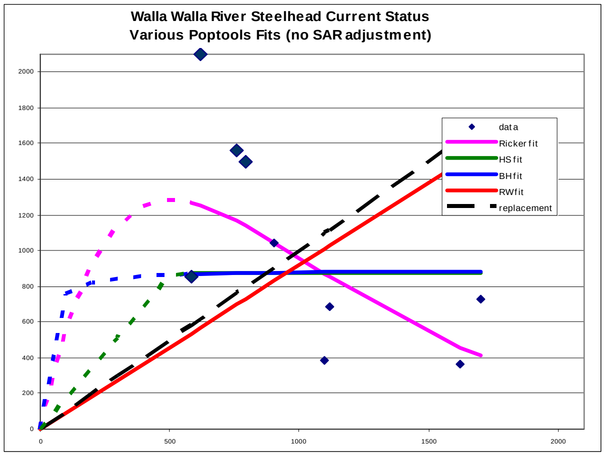


Figure 6-10h. Stock-recruitment curves for Walla Walla Steelhead population. Data not adjusted for marine survival.

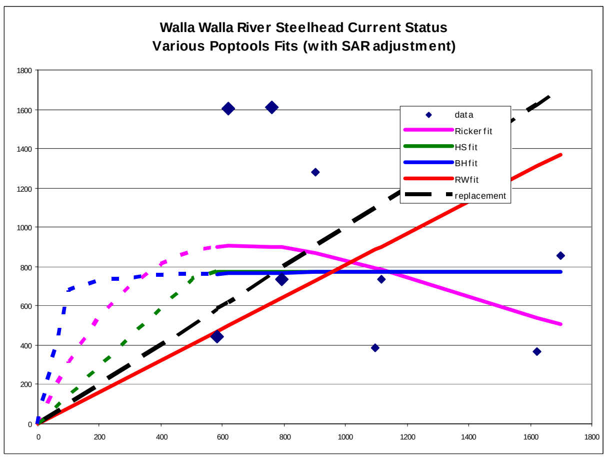


Figure 6-10i. Stock-recruitment curves for Walla Walla Steelhead population. Data adjusted for marine survival.

6.2 Major Population Groups Viability Assessments

The status of each MPG is assessed based on the status of the constituent populations. To achieve viable status in the Cascades Eastern Slope Tributaries MPG, the Fifteenmile Creek, Deschutes River Eastside, and Deschutes River Westside populations must all achieve viable status. The Cascades Eastern Slope Tributaries MPG is below viable status because Fifteenmile Creek, Deschutes River Eastside and Deschutes River Westside populations did not meet viability criteria, and the Deschutes Crooked River population is extinct. (Table 6-11).

Table 6-11. Viability assessment results for Mid-Columbia River steelhead populations in the Cascades Eastern Slope Tributaries MPG.

		Abundance		Productivity			Goal A	Goal B		
Population	Extant/ Extinct	Mean	Lower 95% CI	Mean	Lower 95% CI	A/P Risk	Natural Processes Risk	Diversity Risk	Integrated SS/D Risk	Overall Population Viability Rating
Fifteenmile Creek	Extant	593	398	2.03	1.35	Moderate	Very Low	Low	Low	Below Viable
Deschutes River Eastside	Extant	1,579	650	1.51	0.42	Moderate	Low	Moderate	Moderate	Below Viable
Deschutes River Westside	Extant	470	316	1.49	1.14	Moderate	Very Low	Moderate	Moderate	Below Viable
Deschutes Crooked River	Extinct	0	NA	0	NA	Extinct	NA	NA	NA	Extinct

To achieve viable status in the John Day River MPG, the Lower John Day Mainstem, North Fork John Day River, and either the Middle Fork John Day River or Upper John Day River populations must achieve viable status. The John Day River MPG is below viable status. The North Fork population is highly viable, however all of the other John Day River populations were below viable status (Table 6-12).

Table 6-12. Viability assessment results for Mid-Columbia River steelhead populations in the John Day River MPG.

		Abundance		Productivity			Goal A	Goal B		
Population	Extant/ Extinct	Mean	Lower 95% CI	Mean	Lower 95% CI	A/P Risk	Natural Processes Risk	Diversity Risk	Integrated SS/D Risk	Overall Population Viability Rating
Lower Mainstem John Day River	Extant	1,800	1,065	2.59	1.87	Moderate	Very Low	Moderate	Moderate	Below Viable
North Fork John Day River	Extant	1,740	1,375	2.41	1.62	Very Low	Very Low	Low	Low	Highly Viable
Middle Fork John Day River	Extant	756	508	1.93	1.39	Moderate	Very Low	Low	Low	Below Viable
South Fork John Day River	Extant	259	168	1.95	1.24	Moderate	Very Low	Low	Low	Below Viable
Upper Mainstem John Day River	Extant	524	399	1.73	1.08	Moderate	Very Low	Moderate	Moderate	Below Viable

To achieve viable status in the Umatilla/Walla Walla Rivers MPG , the Umatilla River population and either the Wall Walla River or Touchet River population must achieve viable status. The Umatilla/Walla Walla Rivers MPG is below viable status because neither the Umatilla River or Walla Walla River populations meet viability criteria (Table 6-13).

Table 6-13. Viability assessment results for Mid-Columbia River steelhead populations in the Umatilla/Walla Walla Rivers MPG.

		Abundance		Productivity			Goal A Natural	Goal B		Overall
Population	Extant/ Extinct	Mean	Lower 95% CI	Mean	Lower 95% CI	A/P Risk	Processes Risk	Diversity Risk	Integrated SS/D Risk	Population Viability Rating
Willow Creek	Extinct	0	NA	0	NA	Extinct	NA	NA	NA	Extinct
Umatilla River	Extant	1,472	988	1.50	1.11	Moderate	Moderate	Moderate	Moderate	Below Viable
Walla Walla River	Extant	1,003	724	1.40	0.74	Moderate	Low	Moderate	Moderate	Below Viable

6.3 ESU Viability Assessment

All major population groups must achieve viable status for the ESU to be considerable viable. The Mid-Columbia River Steelhead ESU is below viable status because none of the MPGs achieved viable status.

Section 7 Viability Gaps

Section will be completed in 2006.

Section 8 Limiting Factors and Threats

8.1 Tributary Habitat Limiting Factors

This section describes habitat-related factors that limit the viability of Mid-Columbia River steelhead. The information in this section will be provided to an expert panel for use in our Delphi Process to prioritize limiting factors and threats. The information will also be the basis for quantitative limiting factor analyses and development of management actions. This chapter will be replaced later with the Expert Panel and Quantitative Modeling results.

In many cases, past land use practices across the region contributed significantly to causing the factors now limiting fish production in the region. Some of these land use practices continue today. However, many landowners now understand the advantages of good conservation practices, and many are already protecting and restoring stream corridors, wetlands, and other natural features on their property that influence the viability of local fish and wildlife populations.

8.1.1 Fifteenmile Creek Population

The Fifteenmile Creek population covers the entire Fifteenmile Subbasin, including the Fifteenmile, Rock, Mosier, Chenoweth, Mill, and Threemile watersheds. The population contains three major spawning areas, which are located in the Fifteenmile Creek watershed. The Upper Fifteenmile MaSA makes up the southern portion of the Fifteenmile Creek watershed including Ramsey Creek, and the Eightmile MaSA and Fivemile MaSA lie in the middle and northern portion of the watershed. Fifteenmile Creek and numerous tributaries provide MCR steelhead spawning habitat in the Upper Fifteenmile MaSA, while Eightmile Creek and Fivemile Creek provide the majority of spawning habitat in the Eightmile and Fivemile MaSAs.

The minor spawning areas for the Fifteenmile Creek population include the lower four miles of Fifteenmile Creek and Eightmile Creek downstream of Fivemile Creek in the Fifteenmile Creek watershed and Threemile Creek, Mill Creek, Chenoweth Creek, Mosier Creek, and Rock Creek outside the Fifteenmile Creek watershed. The geology of the MiSAs is similar to that of the MaSAs described above.

Habitat Conditions

Six habitat characteristics are used below to characterize the limiting factors for the Fifteenmile population of MCR steelhead. These include habitat complexity, fish passage, riparian condition, water quality, water quantity, and substrate. Habitat indicators from the National Marine Fisheries Service’s Matrix of Pathways and Indicators were used in the discussion below to further describe each characteristic (NMFS 1996).

The identified limiting factors reflect findings from EDT and QHA analyses conducted in 2004. EDT was applied to the known or potential range of steelhead in the Fifteenmile Watershed while QHA was applied to all other watersheds and non-steelhead streams in the Fifteenmile

Watershed. Steelhead range in the Fifteenmile Watershed was divided into forty-one reaches, and habitat characteristics were described by biologists and natural resource managers familiar with the Fifteenmile Watershed. EDT used this information to estimate life history diversity, productivity, capacity, and abundance. Limiting factors by stream reach and priorities for restoration and protection can be found in NPCC, 2004a.

Habitat Complexity

Presettlement conditions in the watershed likely consisted of unconfined low-gradient channels on broad floodplains, with extensive beaver activity that resulted in abundant high quality off-channel habitat. Stream channels likely contained abundant large wood from surrounding riparian hardwood galleries, including cottonwood and upstream conifer forests. Stream temperatures in the middle and lower portions of the watershed were likely sufficient to support all steelhead life stages throughout the year. Upland and riparian conditions allowed for the storage and release of cool water during summer months and provided shade sufficient to keep water temperatures cool. Streambank erosion was likely rare, with extensive and abundant riparian vegetation and large wood to stabilize the streambanks.

In-channel large wood in the Fifteenmile Subbasin has declined considerably from historic levels due to channel cleanout and removal of source trees through timber harvest, roading, development of residences and farmland, livestock grazing, and other forms of riparian destruction. Large wood has been added to streams and floodplains in the Fifteenmile Creek watershed through several restoration projects since the late 1980s, but is still lacking in many streams. The lack of large wood has resulted in reduced pool frequency and quality.

Development of irrigated farms and pastures on the floodplain and throughout the valley floor ─ and associated channel straightening and confinement ─ reduced available off-channel habitat and floodplain connectivity within the Fifteenmile Subbasin. Off-channel habitat and floodplain connectivity was reduced further by channel straightening and debris removal associated with “flood restoration.” In addition, off-channel habitat and floodplain connectivity decreased when beaver numbers were drastically reduced by trapping before 1900 (NPCC 2004a). Stream straightening and debris removal increased stream energy and channel downcutting, causing streams to abandon floodplains and associated off-channels. It also led to increased bank erosion and a higher width/depth ratio. Streambank erosion has increased considerably over background levels resulting in direct input of large volumes of sediment and a corresponding increase in width/depth ratio. Some bioengineering projects have been undertaken in the Fifteenmile Creek watershed, and riparian restoration will function to stabilize streambanks, but more restoration is needed.

Recent large wood placement and riparian restoration within the Fifteenmile Creek watershed will increase off-channel habitat and floodplain connectivity by encouraging channels to aggrade. Large wood placement will function to restore processes in the short term, but riparian restoration will restore processes over the long term.

Fish Passage

Many physical barriers in the Fifteenmile Creek watershed have at least been partially fixed, but some remain. Fish screens have been installed on eighty diversions and five fish ladders have been installed at diversion structures. Although the fish ladders are no longer barriers to adults, they may still be barriers to upstream juvenile migration (NPCC 2004). A 1998 ODFW culvert survey identified eleven culverts not meeting fish passage criteria on intermittent streams. The streams affected by these culverts are listed under the proper MSA discussion below.

Extensive irrigation withdrawals and the dry climate result in very low flows in most Fifteenmile Subbasin streams during the summer. In some of the smaller tributaries, flows completely dry up in the summer. These shallow water depths can prevent fish passage. Low flows from irrigation withdrawals or degraded riparian condition also create thermal barriers due to high summer water temperatures, particularly in the lower portions of the Fifteenmile Creek watershed. Water temperatures in late summer in lower Fifteenmile Creek, Eightmile Creek, and Fivemile Creek are too high to allow for passage of any life stages.

Riparian Condition

Roads played a major role in degrading riparian habitat in the Fifteenmile Subbasin. Roads are located in many riparian areas (Northwest Subbasin Geographic Data Browser http://nppc.bpa.gov/open_window.htm) and confine stream channels and eliminate riparian vegetation. Some roads have been eliminated in riparian area on National Forest lands, but the middle and lower portions of the watershed still contain extensive riparian roads.

Human settlement in the Fifteenmile Subbasin has considerably degraded riparian condition and connectivity. By 1910, irrigated farms and pastures occupied the floodplains of Fifteenmile, Eightmile, and Fivemile creeks. Below the forested areas, riparian vegetation and large woody debris was nearly gone well before1980 due to extensive management associated with residences, agriculture, flood control, livestock grazing, and roads (NPCC 2004a). Riparian impacts were also present in forested areas, but to a lesser extent. Since 1980, riparian buffers in the Fifteenmile Creek watershed have been established in many areas, but there are several areas that could still benefit from buffers.

Riparian buffer programs and various restoration projects have been implemented to protect and restore riparian habitat. There has been a sharp reduction in timber harvest on Forest Service land within the Fifteenmile Creek watershed since the adoption of the Northwest Forest Plan (NWFP) in 1990. However, private timber harvest still occurs, in fact a large tract including riparian habitat was harvested in 2004. Since 1980, the Forest Service has been working to replace large wood in channels and on floodplains (NPCC 2004a). Riparian conditions are improving in the lower parts of the watershed through ODFW and USDA programs, and beavers have started re-colonizing the lower watershed. Approximately 126 miles of stream in the watershed is protected through some form of riparian buffer, either through the NWFP or programs available to private landowners.

Water Quality

The effect of increased water temperatures is greatest in the lower part of the watershed. Spawning occurs in most presettlement spawning areas, but temperatures become too high to support one or more life stages. Despite recent riparian improvements, temperatures in the lower watershed during portions of the summer remain above lethal limits for cold-water fish (NPCC 2004a). Some areas in the watershed exceed the cold-water and rearing standards and are believed to exceed the spawning standard as well, although most of the temperature monitoring has occurred during the summer.

Suspended sediment, due to erosion associated with land management activities, degrades water quality. By 1950 soil loss due to water erosion associated with tilled agriculture in the Fifteenmile Creek watershed was as high as 20 tons per acre per year. Steep slopes and clean tillage were largely responsible for the soil loss. The adoption of minimum-till and no-till techniques on over half of the tilled acreage has reduced erosion and fine sediment delivery to streams. However, rates of erosion and sediment delivery are still elevated above presettlement rates (NPCC 2004a).

There is a lack of information regarding chemical contaminants and nutrients in streams in the Fifteenmile Creek watershed. It is likely that levels of both are above presettlement levels because of fertilizer and pesticide use for agriculture.

Water Quantity

Precipitation in the drainage ranges from 65 to 80 inches/year in the headwaters to only 10 inches/year on the eastern border. Since most of the precipitation falls during the winter, most of the tributaries originating at lower elevations are intermittent.

Altered natural flows inhibit steelhead production within the Fifteenmile Creek watershed (NPCC 2004). Irrigation is the largest water user, and all summer flows have been fully appropriated for irrigation since the early 1900s. With the conversion of shrub-steppe habitat in the watershed to agricultural land, peak flows increased by as much as 600% between 1850 and 1950, and since very little water was being retained in the soil base flows decreased. Peak flows have the greatest potential for recovery by returning to native vegetation, however, peak flows have partially recovered with the adoption of no-till techniques. Over half of the agricultural land in the watershed has been converted to direct-seed/no-till systems which reduce runoff and erosion by increasing infiltration, leaving 50,000 to 60,000 acres that could be converted (NPCC 2004a). Runoff has increased on forest land by 1 to 6% due to timber harvest and roads (NPCC 2004a).

The loss of beaver in the drainage further reduced base flows. Historically, beavers played an important role in moderating peak and base flows by building dams that held water from high flows so that it could be released during the dry summer months. Water backed up by the beaver dams infiltrated and was stored in riparian soils for release during base flows. Beavers are returning to the Fifteenmile Creek watershed.

There has been a considerable increase in the drainage network due to the abundant roads and stream crossings in the Fifteenmile Subbasin. Roads and ditches increase runoff by intercepting ground water from cut slopes and collecting precipitation and routing it directly to stream channels.

Substrate

Fine sediment in spawning gravel is the primary concern relative to substrate in the Fifteenmile Subbasin. Spawning gravel availability is a lesser concern. The Dalles Formation which combines with the basaltic flows to make up the geologic landscape of the subbasin is a highly erodible layer of pyroclastic sandstone (NPCC 2004a). In the Fifteenmile Creek watershed, extensive soil loss associated with tilled agriculture has contributed to increased fine sediment in spawning gravel. In addition, riparian road densities are highest on private land adjacent to Fivemile, Eightmile, and lower Fifteenmile creeks. These areas have more than a half mile of road per mile of stream within 200 feet of the stream. Forest Service pebble counts have found elevated levels of sand and fine sediment in streams throughout the watershed (NPCC 2004a). EDT identified sedimentation as one of the key factors inhibiting steelhead production (NPCC 2004a). Conversion of more than half of the previously tilled land in the watershed to direct seed/no-till systems has reduced the volume of sediment being contributed to streams, but levels are still elevated. The geology lends itself to fine sediment production, so any management that disturbs the soil will increase fine sediment production.

Limiting Factors

Quality habitat in the Fifteenmile Creek watershed is limited to the upper portion of the watershed where water quality and habitat conditions are sufficient to support all life stages of steelhead. However, these areas are not in a natural state due to management activities and require some restoration. Portions of the middle and lower watershed cannot support any steelhead life stage during late summer due to high water temperatures or dry streams (NPCC 2004a). These areas are significantly degraded by water withdrawals. The six habitat characteristics in the lower portions of the Fifteenmile Creek watershed are all degraded. The lower portions of Fifteenmile, Eightmile, and Fivemile creeks have been most impacted by low flows, high water temperatures, sedimentation, channel confinement, and overall habitat loss. This combination has led to the assumption that fish survival is minimal in these areas resulting in loss of life history diversity and rearing distribution (NPCC 2004a).

Conditions are similar in the MiSAs. The segments of Threemile Creek and Mill Creek running through The Dalles are heavily impacted by roads and residences with very low spawning potential. These segments currently function as migration corridors. The areas above the city are impacted by orchards, but provide potential for spawning. Chenoweth Creek is impacted by The Dalles urban area to a lesser extent, but a variety of streamside landowners make consistency in management difficult. With restoration, Chenoweth Creek has the potential to provide 3.5 miles of steelhead habitat. Mosier Creek only provides 0.4 miles of steelhead habitat due to a barrier falls and that length of stream is protected by the City of Mosier. However, degraded riparian conditions and water use above the falls has a negative impact on water quality and quantity below the falls, so restoration above would benefit downstream steelhead habitat. The lower mile of Rock Creek is heavily impacted by the bridges and the ODOT rock quarry.

Generally, EDT analysis shows that habitat complexity ─ including habitat diversity, key habitat quantity, and channel stability ─ have been degraded by the straightening and channelization of streams, and other factors. In response to flooding in 1964, in the 1970s channels were straightened, berms were constructed adjacent to streams, and large wood was removed from channels (NPCC 2004a). Stream reaches have also been straightened and channelized in attempts to protect floodplain roads, residences and associated structures, and farmland. EDT rated most of the Fifteenmile Creek watershed, except Dry Creek, as a moderate priority for restoring habitat diversity for spawning, active rearing of all age classes, juvenile migration, winter inactivity, and prespawning holding (NPCC 2004a).

Approximately 30 miles of anadromous habitat lack a forested buffer in the watershed. Details for MiSA riparian buffers are discussed below. The desired condition is to have functional riparian habitat throughout the Fifteenmile Subbasin.

Upper Fifteenmile MaSA

Aerial photos show Fifteenmile Creek to be shorter and steeper now than it was before the 1970s (NPCC 2004). Riparian restoration and buffers conducted to date will help restore some of the historic stream length, but more work is needed. EDT rated Dry Creek as a high priority for restoring habitat diversity for spawning, active rearing of all age classes, juvenile migration, winter inactivity, and prespawning holding (NPCC 2004a). It also rated Dry Creek and reaches 2, 3, and 8 of Ramsey Creek as moderate priorities for restoring key habitat quantity (NPCC 2004a). EDT rated Reach 8 of Ramsey Creek as a moderate priority for restoring channel stability (NPCC 2004a).

EDT gave priority for protection of 15 miles of Fifteenmile Creek above its confluence with Ramsey Creek. The Mt. Hood NF manages 7.6 of these miles as riparian reserves. Below the Forest boundary, the next 3.85 miles are owned by the Dufur Water Commission which manages them for water quality and floodplain function (NPCC 2004a). However, the Dufur Water Commission has proposed to harvest timber in this area in the near future. Approximately half of the remaining four miles of priority protection area is enrolled in the ODFW buffer program, leaving two miles of stream needing protection. EDT also gave priority for protection of 6.8 miles of Ramsey Creek from RM 4.1 to RM 10.9, all of which is managed by the Forest Service. Approximately half of it was restored under a large restoration project (NPCC 2004a). In a recent survey of the lower 20 miles of Fifteenmile Creek, more than 30 beaver dams were noted (NPCC 2004a). Beaver presence is not necessarily an indicator of riparian health, but indicates that there must be sufficient forage in the form of riparian hardwoods. Recolonization by beaver will aid in riparian recovery by storing water for vegetation.

Within this MaSA, Dry Creek (RM 0-16.6), Fifteenmile Creek (RM 0-40), and Ramsey Creek (RM 0-5.4) are on the 303(d) list for temperature. Fifteenmile Creek (RM 0-52.7) and Ramsey Creek (RM 0-13.2) are listed for sedimentation. During the summer, temperatures in Fifteenmile Creek increase rapidly once it enters the Dufur Valley. For example, on August 1, 2002 the maximum surface temperature rose from 13ºC at the Forest boundary to 22ºC at the City of Dufur,[1] a distance of at least 13 miles. EDT rated Fifteenmile Creek from Seufert Falls to Ramsey Creek and Dry Creek as high priorities for reducing summer water temperatures, while Reach 9 of Fifteenmile Creek (immediately upstream of Ramsey Creek) and Reach 1 of Ramsey Creek were rated as moderate priorities for reducing summer water temperatures (NPCC 2004a).

[1] SWCD/DEQ Infrared aerial survey, 2002 cited in NPCC 2004.

EDT rated Fifteenmile Creek up to Pine Creek, Dry Creek, and the first reach of Ramsey Creek as high priorities for restoration of low flow, and most of the rest of the MaSA was rated as a moderate priority for restoration of low flow. EDT rated Fifteenmile Creek between Seufert Falls and Dry Creek, Dry Creek, and Reach 1 of Ramsey Creek as high priorities for decreasing peak flows, and most of the remaining channels, except for the headwaters, were rated as moderate priorities for decreasing peak flows (NPCC 2004a).

There are two total adult barriers on Ramsey Creek on the Mt. Hood NF blocking 2,357 feet of headwater habitat (NPCC 2004a). The 1998 ODFW culvert survey identified culverts in Long Hollow, Douglas Hollow, Standard Hollow, and Mays Canyon Creek that did not meet fish passage criteria (NPCC 2004a).

Eightmile MaSA

EDT rated Reach 4 of Eightmile Creek as a high priority and reaches 10-14 of Eightmile Creek as a moderate priority for restoring key habitat quantity (NPCC 2004a). EDT rated reaches 2, 3, 4, and 6 as moderate priorities for restoring channel stability (NPCC 2004a).

EDT gave priority for protection of 14.3 miles from Wolf Run Creek upstream to the impassable culverts at Lower Eightmile Campground. Some of this area is aleady protected. The upper 7.7 miles is managed by the Forest Service under the NWFP and 2.7 miles immediately downstream of the Forest boundary are protected until 2015 by a 400-foot CREP buffer. Downstream, there are 1.6 miles enrolled in the ODFW buffer program, leaving approximately two miles of stream needing protection (NPCC 2004a).

Within the MaSA, Eightmile Creek (RM 0-22) is on the 303(d) list for temperature. EDT rated reaches 1-6 as high priorities for flow restoration and reducing summer water temperatures. Reaches 2-5 of Eightmile Creek rated high for decreasing peak flows, and most of the remainder of Eightmile Creek, except for the headwaters, rated as a moderate priority for decreasing peak flows (NPCC 2004a). Temperatures in Eightmile Creek increase considerably between the Forest boundary and Japanese Hollow (NPCC 2004a). Within the Eightmile MaSA, Eightmile Creek (RM 0-34.5) is on the 303(d) list for sedimentation.

Two culverts at the Eightmile Campground on Eightmile Creek are total barriers to adult steelhead migration, blocking 4,391 feet of headwater habitat (NPCC 2004a). The Endersby Road culvert on Eightmile Creek at RM 10 is a barrier to juveniles at summer flows and an adult barrier at flows they rarely experience. Infrared surveys showed that temperatures just downstream of this culvert were 6ºC warmer than upstream of the culvert, so this culvert could have a significant effect on juvenile survival during summer (NPCC 2004a). The 1998 ODFW culvert survey identified at least one culvert on Japanese Hollow that did not meet fish passage criteria (NPCC 2004a).

Fivemile MaSA

EDT rated most of Fivemile Creek and Middle Fork Fivemile Creek as moderate priorities for restoring key habitat quantity (NPCC 2004a). Fivemile Creek Reach 3 rated as a moderate priority for restoring channel stability (NPCC 2004a).

EDT gave priority for protection to 3.8 miles of Fivemile Creek upstream of the confluence with the North Fork, and 4.8 miles of the Middle Fork from the mouth to the culvert barrier on Forest Road 4430. The entire Middle Fork is managed by the Forest Service under the NWFP. The 3.8 miles of Fivemile Creek are on private land, none of which is enrolled in a buffer program (NPCC 2004a).

Fivemile Creek (RM 0-17.9) is on the 303(d) list for temperature and sedimentation. EDT rated Fivemile Creek below the North Fork as a high priority for reducing summer water temperatures and for flow restoration, low and peak flows. Fivemile Creek between the North Fork and Middle Fork rated as a moderate priority for flow restoration, both low and peak flows (NPCC 2004a).

One culvert on Middle Fork Fivemile Creek is a total barrier to adult steelhead migration, blocking 875 feet of headwater habitat (NPCC 2004a). The 1998 ODFW culvert survey identified at least one culvert on North Fork Fivemile Creek that did not meet fish passage criteria (NPCC 2004a).

Threemile MiSA

Threemile Creek may have provided up to 10 miles of steelhead spawning habitat historically (NPCC 2004a). However, downstream passage barriers need to be fixed before fish can access the area. The I-84 culvert prevents steelhead from accessing the Threemile Creek watershed, and a 20-foot headcut at RM 4.5 is also a barrier. ODOT is planning to fix the I-84 culvert in 2006. There are also other potential barrier between the culvert and the headcut.

Riparian vegetation along Threemile Creek is limited to a narrow strip, the stream is incised, and it is confined by orchards and pastures (NPCC 2004a). Extensive orchards have been developed in the lower valley bottom of Threemile Creek. Threemile Creek has 1.51 miles of riparian buffer, but none of the 4.5 miles of anadromous habitat is protected (NPCC 2004a).

QHA rated Threemile Creek reaches above the City of The Dalles as priorities for channel form and habitat diversity restoration. Reaches above the City of The Dalles also rated as priorities for restoration of summer flows, temperature and agrichemical contamination. However, it would be beneficial to restore water quality to the mouth of Threemile Creek.

Threemile Creek (RM 0-14.6) is on the 303(d) list for temperature. Malathion was found in a single water sample from Threemile Creek in 2002 or 2003. Wasco County Fruit and Produce League and Wy'East Resource Conservation and Development Council have developed an Integrated Fruit Production program to minimize the use of and impacts from broad-spectrum pesticides (NPCC 2004a). The program is beneficial, but not all producers are part of the program.

Mill MiSA

Historical riparian vegetation throughout the Mill Creek watershed likely consisted of mixed conifers and hardwood galleries. The mouth of Mill Creek contained an extensive delta, which was eliminated when it was placed in an 800-foot culvert at its mouth (NPCC 2004a).

Today, extensive orchards exist in the lower valley bottom of Mill Creek. Mainstem Mill Creek is downcut and most of its length has been confined by roads, residences, and agricultural land. Similar to Threemile Creek, riparian vegetation is limited to a narrow strip, the stream is incised, and it is confined by orchards and pastures (NPCC 2004a).

The City of The Dalles covers approximately 3,000 acres and about half of it is impervious surface. Most of the storm sewer system from this area dumps into Mill Creek below RM 1 (NPCC 2004a). South Fork Mill Creek is heavily diverted for the municipal drinking water supply of The Dalles significantly reducing the amount of water in South Fork Mill Creek and Mill Creek.

QHA rated Mill Creek reaches above the City of The Dalles as priorities for restoration of summer flow, channel form and habitat diversity. North Fork Mill Creek and South Fork Mill Creek, between Wick's Water Treatment Plant and Mill Creek Falls, rated as the highest protection priorities (NPCC 2004a). Between the Forest Service and the City of The Dalles, 27 miles of salmonid habitat is protected in the Mill Creek watershed, 11 of which provide anadromous habitat. There is approximately 18.5 miles of anadromous habitat not protected in the watershed. There are 6.5 miles of anadromous habitat on North Fork Mill Creek that are not protected (NPCC 2004a). QHA determined that Mill Creek reaches above the City of The Dalles are a priority for restoration of temperature and agrichemical contamination.

Mill Creek (RM 0-7.7), North Fork Mill Creek (RM 0-3.7), and South Fork Mill Creek (RM 0-8.5) are on the 303(d) list for temperature. ODEQ water sampling in 2002 and 2003 showed the presence of pesticides in Mill Creek in 2002 and 2003 (NPCC 2004a). As described above, an Integrated Fruit Production program has been developed to minimize pesticide impacts.

Numerous structures prevent fish passage in Mill Creek at low flows, including the city's water pipeline which follows the stream and crosses it many times. When structures have become an obvious passage barrier, the city has temporarily addressed the problem by filling the scour hole below the structure with large rock. It is uncertain whether such fixes will function in the long term (NPCC 2004a).

Chenoweth MiSA

Below 10th Street, Chenoweth Creek is impacted by a variety of land uses including urban development. Above 10th Street, Chenoweth Creek is in relatively good condition because it is in the bottom of a steep canyon (NPCC 2004). There are 3.5 miles of potential anadromous habitat in Chenoweth Creek, but none of it is officially protected. Northwest Aluminum has voluntarily fenced 0.24 miles near the mouth to keep horses away from the stream (NPCC 2004a).

Chenoweth Creek (RM 0-7.9) is on the 303(d) list for temperature. The Highway 30 underpass at RM 0.25 is an adult passage barrier under most flow conditions.

Mosier MiSA

Mosier Creek flowed through an extensive alluvial delta with a dense cottonwood gallery before the construction of Bonneville Dam. Today, the creek is confined by rural residences in the lower part of the watershed (NPCC 2004a). Mosier Creek likely had higher flows historically than now due to input from groundwater. The USGS found, in the 1960s, that Mosier Creek gained flow as it intersected the upper end of the Priest Rapids aquifer. However, in a 1980s duplicate study, the Oregon Water Resources Department found that Mosier Creek lost flow when it intersected the same geologic layers, indicating a loss of aquifer hydrologic head (NPCC 2004a).

The 0.4 miles of anadromous habitat on Mosier Creek at the mouth is protected as undeveloped wildland by the City of Mosier. However, this section of stream is high in sediment with very little gravel and water temperatures are high throughout the summer. Approximately 26 miles of salmonid habitat above the barrier falls is not protected.

Mosier Creek (RM 0-16.1) and West Fork Mosier Creek (RM 0-7.9) are on the 303(d) list for temperature. Water temperatures in the lower 0.4 miles of Mosier Creek are high during the summer.

Rock MiSA

The lower mile of Rock Creek has been confined to accommodate the ODOT rock quarry, a private building, the US 30 bridge, the Union Pacific trestle, a recreational parking lot, and the I-84 bridge (NPCC 2004a).

Rock Creek (RM 0-10.6) is on the 303(d) list for temperature.

Life Stages Affected

Loss of habitat complexity affects every life stage of steelhead using streams in the Fifteenmile Subbasin. Effects of reduced habitat complexity on incubation are the least obvious. The egg-to-parr life stage (incubation) is negatively affected when reduced channel stability puts redds at risk of scour during high flows. The parr-to-smolt life stage (juvenile rearing) is greatly affected as simplified habitat reduces velocity cover and food sources. Reduced habitat complexity affects the smolt life stage as less cover and food are available during outmigration. Smolts become more vulnerable to predation and may have less stored energy since prey availability has decreased. Reduced habitat complexity also affects the adult life stage by increasing velocities and energy demands for upstream migration, and decreasing pool habitat for holding and overhead cover for protection from predators. In addition, reduced complexity results in decreased spawning gravel retention.

Structural barriers to fish passage affect upstream migrating adults and juveniles. Unscreened or poorly screened diversions can be a problem. Most diversions are screened, but require maintenance. The majority of adult barriers have been fixed, but juvenile barriers are still present. A juvenile barrier is a major problem when juveniles cannot access upstream thermal refugia due to a barrier.

All life stages of steelhead using the Fifteenmile Subbasin are negatively affected by the degraded riparian condition. A lack of streambank vegetation and associated habitat complexity, including large wood, results in increased stream energy and increased risk of redd scour. Juveniles are negatively affected by poor riparian condition because loss of overhead cover makes them more vulnerable to predation, and loss of velocity cover leaves them vulnerable to displacement during high flow events. Riparian area degradation also reduces inputs of terrestrial food sources. Smolt outmigrants and adults are more vulnerable to predation with reduced vegetative cover, increased sedimentation, and upstream migrating adults face higher water velocities with degraded riparian condition and associated decrease in habitat complexity.

High water temperatures negatively affect spawning, egg incubation, fry colonization, and rearing of all age classes, particularly in the middle and lower portions of the watershed where temperatures may be too warm for successful spawning and egg incubation. Fry are unable to colonize areas with high water temperatures. Juveniles that drop down into the lower portions of the watershed when temperatures are cool may not be able to migrate upstream quickly enough to avoid lethal temperatures, or they may be forced to migrate at a younger age to escape high temperatures. Suspended sediment can negatively affect juveniles and adults by interfering with respiration, and can negatively affect juveniles by reducing foraging efficiency. Once sediment is deposited it can negatively affect egg incubation as discussed below in the substrate section.

Decreased low flows primarily affect juvenile rearing, but also affect egg incubation and emergence. Rearing juveniles are the only life stage present during the summer when low flows are a problem, however, irrigation withdrawals begin while eggs are still in the gravel and fry are emerging. Decreased low flows reduce the amount of habitat available, contribute to increased stream temperatures, create fish passage barriers, and dry out redds. Also, if flows are reduced during adult migration the upstream distribution of spawners will be limited, forcing them to spawn in lower reaches.

Increased peak flows affect all life stages present in the Fifteenmile Subbasin. Peak flow timing often coincides with adult migration and spawning. Increased peak flows may cause adults to spawn in different areas. Incubation is affected by increased peak flows due to increased risk of redd scour. Increased peak flows can also displace rearing juveniles if velocity refugia are insufficient. However, increased peak flows coinciding with smolt outmigration are beneficial, because they decrease the time and energy necessary for migration.

Increased fine sediment in the substrate affects all life stages in the Fifteenmile Subbasin. Spawning adults may select different areas to spawn due to increased fine sediment. Pools filled with fine sediment contain reduced habitat quantity and quality for rearing juveniles, outmigrating smolts, and holding adults. Increased fine sediment in the substrate changes the rearing juvenile prey base by altering the macroinvertebrate assemblage. Incubation is negatively affected because interstitial flow over eggs is insufficient to provide necessary oxygen levels and metabolic waste removal. Emerging fry become entombed because interstitial spaces are clogged with fine sediment. Pesticide contamination affects all life stages. Besides the risk of death there are many sub-lethal effects including effects on development, growth, and behavior. The Dalles urban area has degraded all of the habitat characteristics. Habitat complexity has been simplified through channel cleanout and destroying riparian habitat, fish passage is degraded by culverts and pipelines, riparian condition is degraded through the loss of riparian vegetation, water quality is impacted by toxic levels of contaminants from roadways and landscaped areas, water quantity is affected by rapid runoff from impervious surfaces, and substrate is affected by bank erosion and scour. Life stage effects for these characteristics have been discussed previously.

Viability Parameters Affected

The four viability parameters are abundance, productivity, spatial structure, and diversity. All four parameters are negatively affected by riparian condition and water quantity, which ultimately affect the other four habitat characteristics. Structural barriers to fish passage also affect all four parameters.

Degraded riparian condition and its influence on habitat complexity, water quality, and substrate negatively affect abundance and productivity through reduced habitat availability and suitability. Degraded riparian condition has resulted in channel straightening, elimination of off-channel habitat, loss of large woody debris, reduced channel roughness, increased water temperatures, and increased sedimentation.

Channel straightening and elimination of off-channel habitat affect abundance and productivity by eliminating stream length, so habitat capacity is reduced.

Increased water temperatures, particularly in the lower Fifteenmile Creek watershed, have considerably reduced the amount of suitable habitat available during the summer, thus reducing the number of juvenile steelhead the watershed is capable of producing and supporting. Increased sedimentation affects abundance and productivity by filling and reducing pool habitat needed during juveniles rearing and adult holding. Increased sedimentation also affects abundance and productivity by greatly reducing incubation success by embedding spawning gravel.

Even though stream flow has the greatest impact on water temperatures, degraded riparian condition contributes to making the lower parts of the watershed uninhabitable for steelhead during the summer by not providing sufficient shade to keep water left in the stream cool. Spatial structure is affected by limiting summer juvenile distribution to the upper parts of the watershed. Life history diversity is affected by eliminating any steelhead life histories that would have life stages occupying the lower portions of the watershed during the summer.

Water quantity, and its influence on habitat complexity, fish passage, water quality, and substrate, affects abundance and productivity by reducing the amount of suitable habitat. Excessive peak flows reduce habitat complexity by transporting large wood downstream, and increased fine sediment in pools and spawning gravels by increasing bank erosion. Thay also put redds with incubating eggs at greater risk of scour.

Reduced low flows affect abundance, productivity, spatial structure and diversity. They create passage barriers that affect abundance and productivity by limiting the amount of habitat juveniles have access to, and lethal temperatures that kill juveniles that are unable to access habitat with suitable temperatures. Increased water temperatures affect abundance, growth, disease, early migration, and productivity by making habitat uninhabitable. Spatial structure is affected by limiting summer juvenile distribution to the upper parts of the watershed. Life history diversity is affected by eliminating any steelhead life histories that would utilize lower portions of the watershed during the summer.

Structural fish passage barriers affect abundance and productivity by reducing habitat steelhead can use, and spatial structure by preventing fish from accessing habitat they used historically. Barriers also affect life history diversity by preventing life histories from occurring that require use of habitat above a barrier.

Pesticide contamination affects abundance and productivity by killing adults, juveniles, and incubating eggs. If death does not result, a whole host of sub-lethal effects can ultimately affect them by making them more vulnerable to predation, disease, competition, or reducing growth. Pesticide contamination also affects spatial structure and life history diversity by making certain stream reaches uninhabitable thereby reducing the area they occupy and eliminating life histories that require those reaches for their expression.

Threats

Roads, residential development, agricultural practices and forest uses are the primary threats to steelhead in the Fifteenmile Creek system. Habitat complexity is affected when roads, residences, and agricultural practices confine channels and simplify riparian habitat. Road crossings and irrigation diversions affect fish passage when they do not allow for safe passage of all life stages. The greatest threats to flow and temperature related are irrigation withdrawals and management activities that degrade riparian habitat. Roads, residences, forestry, and agriculture practices primarily threaten riparian condition when they simplify riparian habitat. These uses also affect substrate when they contribute fine sediment to the streams or confine streams to the point that bank erosion is increased.

Water quality is primarily threatened by water withdrawal, with roads, residences, agricultural practices and forest management also contributing. Water withdrawal reduces the amount of in-channel water available to moderate temperatures, while roads, residences, agricultural practices, and forest management in riparian areas reduce shade to streams. Roads, residences, agricultural practices, and forest management are all capable of contributing fine sediment, chemical contaminants, and nutrients to streams.

Low flows are affected by irrigation withdrawals, and by the withdrawal of drinking water from South Fork Mill Creek. The primary threats to peak flows are soil tilling, timber harvest, and roads.

8.1.2 Deschutes River Eastside Population

The Deschutes River Eastside population of Mid-Columbia River steelhead contains five major spawning areas: Buck Hollow, Bakeoven, Ward/Antelope/Cold, Lower Trout, and Upper Trout. It also contains two minor spawning areas: Macks Canyon and Jones Canyon. This population includes the Deschutes River from its mouth to Trout Creek and all of the tributaries flowing in from the east side, including Willow Creek above Pelton Dam.

Habitat Conditions

Habitat Complexity

Before European settlement, abundant hardwood riparian vegetation provided in-channel large wood for adult and juvenile cover. Deep pools provided areas of refuge for juveniles during warm summer temperatures (NPCC 2004b).

Today, habitat complexity is generally impaired in most stream reaches. Large wood and pool habitat is lacking, thus limiting salmonid production. During summer low flows, there are a small number of pools with little cover that provide the only available habitat for juveniles and adults. The result is a large number of fish in a small area with very little cover, exposing them to potential predation (NPCC 2004b).

EDT identified reduced habitat diversity as a major factor limiting steelhead in the Buck Hollow, Bakeoven, and Trout creek systems. Reduced habitat diversity ranked as extreme or high for several reaches. Other major limiting for these streams include the loss of instream habitat complexity and pool habitat for rearing, reduced spawning habitat diversity and high temperatures for egg incubation and 0-age rearing, and low flow for 0- to 2-age rearing (NPCC 2004b). EDT also identified habitat diversity for spawning and rearing and channel stability as major habitat constraints in the smaller tributaries (NPCC 2004b).

Riparian Condition

Historically, the area contained stream corridors well vegetated with deciduous vegetation and grasses (NPCC 2004b). Beavers were abundant in the eastside tributaries, and played an important role as soils in many eastside stream systems are not very permeable and are prone to landslides.

Streams on the lower eastside of the Deschutes have been considerably impacted by beaver harvest, irrigation, roads, and cattle grazing. With the loss of riparian vegetation, streams began eroding vertically and horizontally during storm events. Roads were located in many of the riparian areas within the subbasin (NPCC 2005). Channel downcutting contributed to lowering the water table, which exacerbated the loss of riparian vegetation (NPCC 2004b). Riparian impacts associated with grazing have been reduced and vegetation is recovering by encouraging early season use, better livestock distribution, shorter use duration, lower intensity of use, and installing exclosures (NPCC 2004b). With the recovery of riparian vegetation, beavers have started recolonizing the eastside tributaries (NPCC 2004b).

Water Quality

Water temperatures in the eastside tributaries naturally rise more quickly and reach higher temperatures than westside tributaries because of warmer air temperatures and more arid conditions (NPCC 2004b).

Irrigation return flows to the Deschutes and its tributaries may pose water quality problems (NPCC 2004b). This is particularly a concern in lower Trout Creek, however little water chemistry analysis has been done to document the impact on water quality.

Much of the upland has been converted to dry cropland, which has resulted in increased sediment delivery to streams increasing suspended sediment. However, the adoption of no-till techniques has reduced sediment delivery to streams (NPCC 2004b).

There is a lack of information regarding chemical contaminants and nutrients in streams in the area. It is likely that levels of both are above presettlement levels because of fertilizer and pesticide use for agriculture.

Water Quantity

The eastside streams are very flashy due to their high average slope, high drainage densities, and occasional severe thunderstorms (NPCC 2004b). The uplands are generally degraded by grazing and agriculture, which reduces the soil's ability to collect and store moisture, contributing to the flashy nature of the streams. Approximately 370,000 acres of contiguous interior grassland that existed in the upper Bakeoven, Buck Hollow, and Antelope watersheds has been lost to encroachment by other habitat types and land use (NPCC 2004b).

There has also been an increase in the drainage network due to roads. Roads and ditches increase runoff by intercepting ground water from cut slopes and collecting precipitation and routing it directly to stream channels.

Combined upland and riparian degradation has resulted in an altered flow regime with higher peak flows and lower base flows. Therefore, flow fluctuations are now greater than they were historically. The water table has been lowered and storage reduced by the incision of headwater channels (NPCC 2004b). Some streams are intermittent in summer months.

EDT identified low flows for 0- to 1-age rearing as a major habitat constraint in the smaller tributaries (NPCC 2004b).

Substrate

Substrate has been degraded by fine sediment deposition from tilling practices associate with dry cropland farming. However, no-till techniques are being adopted which has greatly reduced erosion and sediment delivery to substrate (NPCC 2004b).

EDT identified sediment during egg incubation as a major habitat constraint in the smaller tributaries (NPCC 2004b).

Limiting Factors

Buck Hollow MaSA

EDT identified Buck Hollow Creek, from the mouth to Macken Canyon, as a priority for protection. EDT also identified Buck Hollow Creek from the mouth to Thorn Hollow and Thorn Hollow from the mouth to the spring in section 23 as priorities for restoration (NPCC 2004b).

Portions of Buck Hollow Creek have down cut and eroded laterally due to historic grazing (NPCC 2004b). Loss of riparian vegetation, channel alterations and flood scouring have contributed to a general lack of instream habitat complexity, LWD and pool habitat in many reaches (NPCC 2004b). Recent changes in grazing management, however, have allowed healthy riparian conditions to become reestablished in many areas accessed by steelhead.

Buck Hollow Creek (RM 0-37.7) is on the 303(d) list for temperature. The wide, shallow nature of Buck Hollow Creek contributes to icing during prolonged cold periods and warming during the summer, both of which can result in fish kill (NPCC 2004b). In Buck Hollow Creek, water temperatures frequently exceed 75ºF except where cool seeps and springs are present (NPCC 2004b).

There is one surface water right for 0.57 cfs in the Buck Hollow Creek watershed near the mouth of Buck Hollow Creek (NPCC 2004b). Flows are naturally low, but degraded upland and riparian conditions from over grazing and upland agricultural practices contribute to reduced water storage and extreme low flows.

Buck Hollow is a gravel-rich system, but fine sediment levels are elevated due to grazing impacts (NPCC 2004b).

Bakeoven MaSA

EDT identified Bakeoven Creek, from the mouth to Deep Creek; Deep Creek, from the mouth to Cottonwood Creek; and Cottonwood Creek, from the mouth to Ochoco Gulch as priorities for protection. EDT also identified Bakeoven Creek from the mouth to Deep Creek, Deep Creek from the mouth to Cottonwood Creek, and Cottonwood Creek from the mouth to Ochoco Gulch as priorities for restoration (NPCC 2004b).

Portions of Bakeoven Creek have down cut and eroded laterally due to historic grazing (NPCC 2004b). Upland management and riparian destruction from livestock grazing affect water quality by increasing sediment and temperature. Fine sediment levels are high in Bakeoven Creek (NPCC 2004b). The wide, shallow nature of Bakeoven Creek contributes to icing during prolonged cold periods and warm temperatures during the summer, both of which can result in fish kill (NPCC 2004b). Bakeoven Creek also naturally experiences high water temperatures, but some anthropogenic factors have increased temperatures (NPCC 2004b).

Streamflow is generally perennial in upper Bakeoven Creek and Deep Creek, but intermittent in lower Bakeoven Creek. There are no active surface water withdrawals, but there are several large irrigation wells (NPCC 2004b). In addition, riparian and upland degradation due to grazing and conversion of uplands to agriculture affect water quantity. Road crossing on Stag Canyon is a fish passage barrier (NPCC 2004b).

Ward/Antelope/Cold MaSA

Irrigation water use exceeds estimated summer flows in most drainages in the Trout Creek watershed (NPCC 2004b). A push-up dam in Antelope Creek between the mouth and Ward Creek during irrigation season is at least a partial barrier to upstream fish passage (NPCC 2004b).

Lower Trout MaSA

Grazing and the conversion of riparian habitat to agricultural land has degraded riparian condition, which has reduced habitat complexity, degraded water quality, increased peak flows, reduced base flows, and increased fine sediment in substrate. A greater percentage of riparian areas are degraded in the Lower Trout MaSA than in the Upper Trout MaSA (NPCC 2004b). Stream channels in the Lower Trout MaSA were simplified following the 1964 flood by building flood-control berms and straightening channels (NPCC 2004b). This work increased stream energy resulting in increased stream bank erosion causing the stream to widen. Some habitat improvement work has been done to increase habitat complexity. Nearly 4,800 in-channel log or rock structures have been placed.

EDT identified summer stream flow, water temperature extremes, channel instability, and habitat diversity as habitat deficiencies in the Trout Creek system. EDT also identified Trout Creek from the mouth to the 4,800-foot level as a high priority for restoration (NPCC 2004b). The Deschutes Subbasin Plan identified riparian and instream habitat restoration in Trout Creek as a top ten restoration priority (NPCC 2004b). Habitat restoration has been taking place in the Trout Creek system since 1986. Riparian fencing, berm removal, and other restoration activities in the Trout Creek system have allowed riparian vegetation to become established which has stabilized stream banks. Approximately 70 of the 170 miles of perennial and intermittent streams in the system have been fenced. However, as identified by EDT, there are still habitat deficiencies that need to be addressed in order to improve habitat conditions for MCR steelhead.

Trout Creek (RM 0-50.7) and Tenmile Creek (RM 0-5.9) are on the 303(d) list for temperature and sedimentation. Stream temperatures in Trout Creek generally exceed recommended levels by late May and may remain high through October (NPCC 2004b).

Summer irrigation withdrawals have drastically reduced base flows in Trout Creek. Irrigation water use exceeds estimated summer flows in all drainages in the Trout Creek watershed resulting in intermittent flows in Trout Creek below Willowdale (NPCC 2004b). Upland management has also contributed to altering the hydrology in the MSA, but projects have been implemented to reduce these impacts. Out of channel restoration has included converting more than 5,600 acres of cropland to permanent grassland, scarifying and seeding over 13 miles of road, and installing more than 50 upland water and sediment basins (NPCC 2004b).

Elevated levels of fine sediment have degraded spawning gravel (NPCC 2004b). Efforts to reduce bank erosion have been undertaken. Approximately 21,000 feet of eroding streambank have been treated with a variety of bioengineering methods. Road culverts affect fish passage

(NPCC 2004b). Mud Springs Creek contains a high gradient concrete box culvert in section 15 that is a barrier, and a culvert just upstream of Gateway that is a barrier. Relocation of Hay Creek has created a barrier cascade in the SW corner of section 17 near the mouth of Hay Creek. Other barriers in Hay Creek include storage reservoirs (NPCC 2004b). Fish passage has been at least partially blocked by irrigation diversions. However, all irrigation diversions have been screened or replaced with infiltration galleries.

Upper Trout MaSA

EDT identified summer stream flow, water temperature extremes, channel instability, and habitat diversity as habitat deficiencies in the Trout Creek system. EDT also identified Trout Creek from Antelope Creek to Little Trout Creek and from Amity Creek to Potlid Creek, Board Hollow Creek from the mouth to the headwaters, Foley Creek from the mouth to the falls, Big Log Creek from the mouth to the headwaters, and Dutchman Creek from the mouth to the headwaters as priorities for protection. Finally, EDT identified Trout Creek from the mouth to the 4,800-foot level as a high priority for restoration (NPCC 2004b).

Grazing, timber harvest, conversion of riparian habitat to agricultural land and other uses contributed to a degraded riparian condition and reduced habitat complexity, degraded water quality, increased peak flows, reduced base flows, and increased fine sediment in substrate (NPCC 2004b). Below the Ochoco NF boundary, stream channels were further simplified following the 1964 flood by building flood-control berms and straightening channels (NPCC 2004b). Riparian fencing in the Trout Creek system has allowed riparian vegetation to become established which has stabilized stream banks in some areas (NPCC 2004b). The Deschutes Subbasin Plan identified riparian and instream habitat restoration in Trout Creek as a top ten restoration priority (NPCC 2004b).

Trout Creek (RM 0-50.7) is on the 303(d) list for temperature and sedimentation. Auger Creek (RM 0-6.5), Big Log Creek (RM 0-5.5), Cartwright Creek (RM 0-4.3), Dick Creek (RM 0-2.2), Dutchman Creek (RM 0-4.8), Potlid Creek (RM 0-5.2), and Bull Creek (RM 0-1.8) is on the 303(d) list for temperature and sedimentation. Stream temperatures in Trout Creek generally exceed recommended levels by late May and may remain high through October (NPCC 2004b). Elevated water temperatures are the result of a lack of shade from degraded riparian conditions and reduced low flows due to irrigation withdrawals and the inability of the soil to store water.

Summer irrigation withdrawals have drastically reduced base flows in Trout Creek. Irrigation water use exceeds estimated summer flows in all drainages in the Trout Creek watershed resulting in intermittent flows in Trout Creek below Ashwood (NPCC 2004b). Roads associated with timber harvest have also altered the hydrology of Trout Creek by increasing peak flows through increasing impermeable surface area and intercepting and delivering subsurface flow directly to stream channels.

Numerous push-up dams block fish passage during irrigation season between Little Trout Creek and Board Hollow Creek. Passage is blocked on Clover Creek during irrigation season by a push-up dam. This diversion is also not screened (NPCC 2004b).

Jones Canyon MiSA

A road crossing on Jones Canyon near the mouth has created a fish passage barrier (NPCC 2004b).

Deschutes River MiSA

EDT identified instream habitat diversity, streambank stability/cover, flow, and temperature as habitat deficiencies in the lower Deschutes River. EDT also identified the segments of the Deschutes River from Moody Rapids to Buck Hollow Creek and from Bakeoven Creek to Trout Creek as priorities for protection. Finally, EDT identified the segments of the Deschutes River from Lower Moody Rapids to Buck Hollow Creek and from White River to Bakeoven Creek as priorities for restoration (NPCC 2004b).

Although large wood delivery to the lower Deschutes River from the upper subbasin is believed to have been low naturally, reservoir construction has eliminated upstream recruitment altogether (NPCC 2004b). Large wood recruitment is limited to tributaries below the Pelton/Round Butte complex and the Deschutes River itself. EDT identified instream and streamside habitat diversity as primary factors limiting steelhead production on several reaches of the Deschutes River below Trout Creek. This is primarily due to limited edge rearing habitat for juveniles (NPCC 2004b). Substrate recruitment is also believed to have been low naturally, but has been futher reduced by construction of the Pelton/Round Butte complex.

The Deschutes Subbasin Plan identified instream and riparian restoration in the lower Deschutes River as a top ten restoration priority (NPCC 2004b). Livestock grazing and, to a lesser degree, recreation use along the Deschutes River has removed riparian vegetation and compacted soils making it difficult for vegetation to become reestablished. However, controls on vehicle and foot traffic and fencing to control livestock have improved conditions considerably over the last 25 years. Riparian fencing has been installed along approximately 45 miles of the Deschutes River, and has been shown to be effective by ODFW photo monitoring. There are approximately 65 miles of shoreline left that is not protected by highway or railroad right-of-ways or fencing (NPCC 2004b).

The Deschutes River (RM 0-46.4) is on the 303(d) list for temperature and pH, and the Deschutes River (RM 46.4-99.8) is on the 303(d) list for temperature, dissolved oxygen, and pH. The lower 46.5 miles of the Deschutes River contain high levels of glacial sand and silt originating from the White River (NPCC 2004b).

Water quantity in the lower mainstem Deschutes before European settlement was very similar to what there is today in the lower 100 miles of the Deschutes River. Flows were and continue to be stable with little variation, due to the large contribution of ground water (NPCC 2004b).

Life Stages Affected

Poor riparian condition affects all life stages of steelhead. Loss of streambank vegetation leads to increased stream energy and increases the likelihood that redds will be scoured during high flows. Poor riparian condition and lack of overhead cover make juveniles more vulnerable to predation. Loss of velocity cover makes them vulnerable to displacement during high flow events. Loss of terrestrial food sources further affects productivity. Smolt outmigrants and adults are more vulnerable to predation with reduced vegetative cover.

Every life stage of steelhead is affected by loss of habitat complexity. Effects on incubation are the least obvious. The egg-to-parr life stage (incubation) is negatively affected when channel stability is reduced. The parr-to-smolt life stage (juvenile rearing) is affected when habitat simplification reduces velocity cover, cover from predators, and food sources. Reduced habitat complexity affects smolts by reducing cover and food available during outmigration, and leaving them vulnerable to predation. Adults are affected when loss of habitat complexity results in higher velocities, increasing energy demands for upstream migration, and reduces pool habitat for holding and overhead cover for protection from predators.

High water temperatures negatively affect spawning, egg incubation, fry colonization, and rearing of all age classes. Fry are unable to colonize areas with high water temperatures. Juveniles that drop down into the lower portions of the watershed when temperatures are cool may not be able to migrate upstream quickly enough to avoid lethal temperatures. Suspended sediment can negatively affect juveniles and adults by interfering with respiration, and can negatively affect juveniles by reducing foraging efficiency. However, suspended sediment also provides cover from predators.

Decreased low flows primarily affect juvenile rearing. Rearing juveniles are the only life stage present during the summer when low flows are a problem. Decreased low flows reduce the amount of habitat available, contribute to increased stream temperatures, and create fish passage barriers. Increased peak flows affect all life stages present in the Deschutes Subbasin. Peak flows can occur during steelhead spawning and affect where adults will spawn. Increased peak flows affect incubation by increasing the risk of redd scour. Increased peak flows can also displace rearing juveniles if velocity refuge areas are insufficient. Increased peak flows coinciding with smolt outmigration can be beneficial, because they can decrease the time and energy necessary for the migration. However, any benefits are cancelled by the negative effects on other life stages.

Adults are affected by structural barriers and by flow and temperature-related barriers that form during dry years in eastside tributaries. Juvenile rearing is greatly affected by all of the passage barriers.

Viability Parameters Affected

The four viability parameters are abundance, productivity, spatial structure, and diversity. All four viability parameters are negatively affected by riparian condition and water quantity which ultimately negatively affect the other four habitat characteristics. Structural barriers to fish passage also affect all four parameters.

Degraded riparian condition and its influence on habitat complexity, water quality, and substrate negatively affect abundance and productivity through reduced habitat availability and suitability. Degraded riparian condition has resulted in channel straightening, elimination of off-channel habitat, reduced channel roughness, increased water temperatures, and increased sedimentation.

Increased water temperatures reduce the amount of suitable habitat, and thus the number of juvenile steelhead the watershed is capable of producing and supporting. Increased sedimentation affects abundance and productivity by reducing juveniles that can rear and adults that can hold through the filling of pools that provide habitat. Sedimentation also affects abundance and productivity by greatly reducing incubation success.

Water quantity affects abundance and productivity by reducing the amount of suitable habitat. Excessive peak flows reduce habitat complexity carry LWD and other stream structure downstream, scour redds, and produces fine sediment that is deposited in pools and spawning gravels. Reduced low flows affect fish passage by making passage past potential barriers difficult or impossible, and by contributing to high water temperatures and other water quality problems.

Spatial structure and life history diversity are primarily affected by reduced low flows, which contribute to high water temperatures, and limits summer juvenile distribution to the upper parts of stream systems. Life history diversity is also affected by eliminating any steelhead life histories that would utilize lower portions of the watershed during the summer.

Structural fish passage barriers affect abundance and productivity by reducing habitat steelhead can use. Barriers to fish passage affect spatial structure by preventing fish from accessing habitat they used historically. Barriers also affect life history diversity by preventing life histories from occurring that require use of habitat above a barrier.

Threats

The primary threats to riparian condition and habitat complexity are grazing, roads, residences, and agriculture practices that simplify habitat. Irrigation withdrawals are the primary threat to low flows, and soil tilling, timber harvest, and roads are the primary threats to peak flows.

The primary structural threats to fish passage are dams, road crossings, and irrigation diversions that do not allow for safe passage of all life stages. The greatest threats to flow and temperature related barriers are irrigation withdrawals and management activities that degrade riparian habitat.

8.1.3 Deschutes River Westside Population

The Deschutes River Westside population of Mid-Columbia River steelhead includes the mainstem Deschutes River from Trout Creek to Pelton Dam and the tributaries flowing from the Westside ─ including the Warm Springs River and Shitike Creek, and the Metolius River and Squaw Creek above the Pelton/Round Butte complex. The area contains five major spawning areas: Lower Warm Springs, Middle Warm Springs, Upper Warm Springs, Mill, and Shitike; and six minor spawning areas: Oak Canyon, White, Wapinitia, Eagle, Skookum, and Deschutes. The Warm Springs watershed and Shitike Creek provide most of the current spawning habitat, but Oak Canyon, lower White River, Wapinitia Creek, Eagle Creek, and Skookum Creek provide some spawning habitat.

Habitat Conditions

Six habitat characteristics are used to characterize the limiting factors for MCR steelhead habitat by population or by MaSA/MiSA depending on their applicability across the population. Habitat characteristics include riparian condition, habitat complexity, water quality, water quantity, substrate, and fish passage. When possible habitat indicators from the NMFS Matrix of Pathways and Indicators (MPI) were used in the discussion to further describe each characteristic (NMFS 1996).

Riparian Condition

Before European settlement riparian vegetation was abundant and diverse in these watersheds, with deciduous and coniferous trees, shrubs, and grasses (NPCC 2004b). Today, the Shitike Creek and Warm Springs River systems have experienced a slight to moderate loss of riparian vegetation and vegetative diversity due largely to grazing, but roads and other types of management have also contributed. Degraded habitat is primarily in lower reaches. Upper reaches however are in good to excellent condition (NPCC 2004b). Riparian fencing in some areas of the Warm Springs River system has allowed riparian vegetation to become established which has stabilized stream banks (NPCC 2004b). Roads have played a major role in degrading riparian habitat in the Shitike Creek and Warm Springs River sysems. Roads are located in many of the riparian areas within the subbasin (NPCC 2005). Roads within riparian areas confine stream channels and eliminate riparian vegetation.

Habitat Complexity

All streams contained complex habitat with healthy riparian vegetation before European settlement. The area offered a wide variety of single-thread and multiple-thread channels depending on valley morphology. Beavers were abundant and created off-channels and wet meadows in open valleys. Large wood was abundant providing high quality cover for fish and sorting gravel for spawning (NPCC 2004b).

EDT identified lack of habitat diversity and complexity as major limiting factors for the Deschutes River above Trout Creek, and for several reaches in Shitike Creek and the Warm Springs River system. Habitat diversity and complexity is limited in the Deschutes River above Trout Creek due to recreation impacts on riparian vegetation on the east side of the river and grazing impacts on the west side of the river. EDT also identified channel instability as a major limiting factor for the Shitike and Warm Springs systems (NPCC 2004b).

Habitat complexity has been reduced in much of this population area including lower Shitike Creek and the Warm Springs River by channel simplification and land use practices (NPCC 2004b). The smaller westside tributaries now contain a lack of habitat complexity due to management resulting in flashy flows that have scoured the channel (NPCC 2004b). Some instream habitat projects have been implemented on the Warm Springs River and have increased habitat complexity (NPCC 2004b). However, habitat remains simplified overall.

Water Quality

Throughout the area, summer water temperatures were cool historically and winter temperatures were moderated, because of the recharge associated with beaver activity, off channel water storage, and healthy riparian vegetation (NPCC 2004b). Fine sediment delivery to streams was limited by stable vegetative conditions before European settlement (NPCC 2004b).

Today, the lower Deschutes River and several Westside tributary reaches are included on the 2002 ODEQ 303(d) list of water quality limited streams (NPCC 2004b). The lower Deschutes River exceeds temperature criteria for salmonid rearing fro White River to Pelton Dam. In addition, water temperatures in lower reaches of Warm Springs River and Shitike Creek can exceed 70°F from mid to late summer. EDT identified water temperature during incubation as a major limiting factor in lower Shitike Creek, Beaver Creek, and several other stream reaches (NPCC 2004b).

The smaller tributaries to the Deschutes River, and Quartz and Coyote creeks in the Warm Springs River system, contain highly erosive soils so watershed stability is fair to poor. Suspended sediment, due to erosion associated with land management activities, degrades water quality. The small Deschutes River tributaries are also unstable due to extensive grazing and conversion of land for tilled agriculture (NPCC 2004b).

There is a lack of information regarding chemical contaminants and nutrients in streams in the area. It is likely that levels of both are above presettlement levels because of fertilizer and pesticide use for agriculture. Irrigation return flows to the Deschutes River and its tributaries may pose water quality problems (NPCC 2004b).

Water Quantity

Tributary flows before European settlement were more stable due to healthy upland condition, abundant beaver activity, and healthy riparian vegetation (NPCC 2004b). Today, uplands have been degraded through grazing, agriculture, timber harvest, and roading, and are not able to capture and slowly release precipitation as efficiently as they did historically. Headwater channel scour has resulted in reduced water storage and lowered the water table (NPCC 2004b). Small tributary flows are often intermittent limiting habitat availability in the summer. EDT identified reduced stream flows as a major limiting factor in this area.

Substrate

Fine sediment levels in spawning substrate are a concern in Shitike and Warm Springs systems and small tributaries to the Deschutes River. Increased fine sediment in small tributaries is the result of cropland and rangeland runoff. Substrate contained less fine sediment before European settlement due to stable vegetation conditions (NPCC 2004b).

The small tributaries to the Deschutes River have become incised and lost some of the steelhead spawning gravel that was historically abundant. In-channel large wood has also been reduced throughout the area which has decreased the ability of streams to sort and store spawning gravel (NPCC 2004b).

Fish Passage

Road and railroad crossings on small tributaries block upstream passage (NPCC 2004b).

Limiting Factors

Lower Warm Springs MaSA

Riparian and instream habitat have been particularly degraded in Beaver Creek by livestock grazing and Highway 26. In addition to instream habitat diversity noted above, EDT identified streambank stability, temperature, and sedimentation as habitat deficiencies in Beaver Creek. The Deschutes Subbasin Plan identified riparian and instream habitat restoration in Beaver Creek as a top ten restoration priority for the Deschutes Subbasin (NPCC 2004b). EDT identified the Warm Springs River from the hatchery dam to Trapper Springs Meadow, and Beaver Creek from the mouth to the headwaters as priorities for protection. EDT also identified the Warm Springs River from the mouth to Schoolie and Beaver Creek from the mouth to Wilson Creek as high priorities for restoration (NPCC 2004b).

Bank armoring and confinement of two to three miles of the Warm Springs River in the Ka-Nee-Ta Resort area have simplified in-channel habitat and reduced riparian vegetation. A section of Beaver Creek has also been confined and simplified by Highway 26, and stream channels have been incised along Quartz and Coyote Creek (NPCC 2004b). Beaver Creek tributaries, Coyote and Quartz creeks, occasionally deliver high levels of suspended fine sediment to Beaver Creek, the Warm Springs River, and the Deschutes River (NPCC 2004b).

Middle Warm Springs MaSA

EDT identified the Warm Springs River from the hatchery dam to Trapper Springs Meadow, and Badger Creek from the mouth to the falls as priorities for protection (NPCC 2004b).

Mill MaSA

EDT identified Mill Creek from the mouth to the headwaters as a priority for protection. EDT also identified Mill Creek from the mouth to Old Mill Camp in section 16 as a high priority for restoration (NPCC 2004b).

Shitike MaSA

Livestock grazing has impacted riparian habitat between the old Warm Springs headworks and the upper road crossing, and riparian habitat has been degraded along lower Shitike Creek where it runs through the City of Warm Springs and adjacent to Highway 26. The stream has been straightened to accommodate Highway 26 and the mill in Warm Springs. EDT identified Shitike Creek from the mouth to the upper road crossing as a high priority for restoration (NPCC 2004b). Shitike Creek is in pristine condition above Peter's Pasture (NPCC 2004b).

Occasional sewage spills from Warm Springs sewage lagoons degrade water quality (NPCC 2004b). Water quality is also degraded by runoff from the Warm Springs mill site and Highway 26.

Oak Canyon MiSA

Oak Canyon (RM 0-6.3) is on the 303(d) list for temperature. Livestock grazing has degraded habitat and runoff from upland agriculture has increased sedimentation.

White MiSA

White River Falls at RM 2.0 is a barrier to all upstream migration (NPCC 2004b).
The White River (RM 0-12) is on the 303(d) list for temperature. Turbidity associated with glacial silt and rock flour also reduces water quality in the lower White River and result in increased substrate embeddedness in the lower 46 miles of the Deschutes River (NPCC 2004b).

Wapinitia MiSA

Wapinitia Creek (RM 0-14.4) is on the 303(d) list for temperature. Livestock grazing, upland agriculture and diversions have all played a role in degrading water quality.

Deschutes MiSA

Livestock grazing on the west side of the river has removed riparian vegetation and compacted soils making it difficult for vegetation to become reestablished. However, recent controls on vehicle and foot traffic and fencing to control livestock have improved conditions considerably over the last 25 years. Many of the private residences along the river have removed all riparian vegetation. Riparian vegetation along the lower Deschutes River has been removed by the construction and maintenance of the railroad (NPCC 2004b). The Deschutes Subbasin Plan identified instream and riparian restoration in the lower Deschutes River as a top ten restoration priority (NPCC 2004b).

EDT identified instream habitat diversity and streambank stability/cover as habitat deficiencies in the lower Deschutes River. EDT identified the Deschutes River from Trout Creek to the Pelton Reregulating Dam as a priority for protection. EDT also identified the Deschutes River from Wapinitia Creek to Shitike Creek as a high priority for restoration (NPCC 2004b).

Although large wood delivery to the lower Deschutes River from the upper subbasin is believed to have been low naturally, reservoir construction has eliminated recruitment completely (NPCC 2004b).

EDT identified temperature as a habitat deficiency in the lower Deschutes River (NPCC 2004b). The Deschutes River (RM 46.4-99.8) is on the 303(d) list for temperature, dissolved oxygen, and pH.

EDT identified flow as a habitat deficiency in the lower Deschutes River (NPCC 2004b). Today’s flow stability in the lower mainstem Deschutes is similar to the flow stability in the river before European settlement. Flows were stable with little variation (NPCC 2004b). However, flows in the Deschutes River have been somewhat altered by upstream dams and irrigation withdrawals. Substrate delivery to the lower Deschutes River from the upper subbasin was likely naturally low, but reservoirs now fully cut off substrate recruitment from the upper subbasin (NPCC 2004b). The lack of large flushing flows has allowed aquatic vegetation encroachment on spawning gravel, and has altered natural sediment movement.

Fish passage was blocked on the Deschutes River at approximately RM 100 with the construction of the Pelton Round Butte complex. Fish passage facilities were constructed, but attempts to pass juveniles out of the system failed. However, efforts are underway to restore passage as part of the FERC relicensing process (NPCC 2004b). The new downstream fish passage structure is scheduled to be functioning by 2010.

Life Stages Affected

Poor riparian condition affects all life stages of steelhead. Loss of streambank vegetation leads to increased stream energy and increases the likelihood that redds will be scoured during high flows. Poor riparian condition and lack of overhead cover make juveniles more vulnerable to predation. Loss of velocity cover makes them vulnerable to displacement during high flow events. Loss of terrestrial food sources further affects productivity. Smolt outmigrants and adults are more vulnerable to predation with reduced vegetative cover.

Every life stage of steelhead is affected by loss of habitat complexity. Effects on incubation are the least obvious. The egg-to-parr life stage (incubation) is negatively affected when channel stability is reduced. The parr-to-smolt life stage (juvenile rearing) is affected when habitat simplification reduces velocity cover, cover from predators, and food sources. Reduced habitat complexity affects smolts by reducing cover and food available during outmigration, and leaving them vulnerable to predation. Adults are affected when loss of habitat complexity results in higher velocities, increasing energy demands for upstream migration, and reduces pool habitat for holding and overhead cover for protection from predators.

High water temperatures negatively affect spawning, egg incubation, fry colonization, and rearing of all age classes. Fry are unable to colonize areas with high water temperatures. Juveniles that drop down into the lower portions of the watershed when temperatures are cool may not be able to migrate upstream quickly enough to avoid lethal temperatures. Suspended sediment can negatively affect juveniles and adults by interfering with respiration, and can negatively affect juveniles by reducing foraging efficiency. However, suspended sediment also provides cover from predators.

Decreased low flows primarily affect juvenile rearing. Rearing juveniles are the only life stage present during the summer when low flows are a problem. Decreased low flows reduce the amount of habitat available, contribute to increased stream temperatures, and create fish passage barriers. Increased peak flows affect all life stages present in the Deschutes Subbasin. Peak flows can occur during steelhead spawning and affect where adults will spawn. Increased peak flows affect incubation by increasing the risk of redd scour. Increased peak flows can also displace rearing juveniles if velocity refuge areas are insufficient. Increased peak flows coinciding with smolt outmigration can be beneficial, because they can decrease the time and energy necessary for the migration. However, any benefits are cancelled by the negative effects on other life stages.

Adults are affected by structural barriers and by flow- and temperature-related barriers that form during dry years in small west side tributaries. Juvenile rearing is greatly affected by all of the passage barriers.

Viability Parameters Affected

The four viability parameters are abundance, productivity, spatial structure, and diversity. All four viability parameters are negatively affected by riparian condition and water quantity which ultimately negatively affect the other four habitat characteristics. Structural barriers to fish passage also affect all four parameters.

Degraded riparian condition and its influence on habitat complexity, water quality, and substrate negatively affect abundance and productivity through reduced habitat availability and suitability. Degraded riparian condition has resulted in channel straightening, elimination of off-channel habitat, reduced channel roughness, increased water temperatures, and increased sedimentation.

Increased water temperatures reduce the amount of suitable habitat, and thus the number of juvenile steelhead the watershed is capable of producing. Increased sedimentation affects abundance and productivity by filling of pools that provide habitat for juveniles and adults. Sedimentation also affects abundance and productivity by greatly reducing incubation success.

Water quantity affects abundance and productivity by reducing the amount of suitable habitat. Excessive peak flows reduce habitat complexity carry LWD and other stream structure downstream, scour redds, and produces fine sediment that is deposited in pools and spawning gravels. Reduced low flows affect fish passage by making passage past potential barriers difficult or impossible, and by contributing to high water temperatures and other water quality problems.

Spatial structure and life history diversity are primarily affected by reduced low flows, which contribute to high water temperatures, and limits summer juvenile distribution to the upper parts of stream systems. Life history diversity is also affected by eliminating steelhead life histories that would use lower portions of the watershed during the summer.

Structural fish passage barriers affect abundance and productivity by reducing habitat steelhead can use. Barriers to fish passage affect spatial structure by preventing fish from accessing habitat they used historically. Barriers also affect life history diversity by preventing life histories from occurring that require use of habitat above a barrier.

Threats

The primary threats to riparian condition and habitat complexity are grazing, roads, residences, and agriculture practices that simplify habitat. Irrigation withdrawals are the primary threat to low flows, and soil tilling, timber harvest, and roads are the primary threats to peak flows.

The primary structural threats to fish passage are dams, road crossings, and irrigation diversions that do not allow for safe passage of all life stages. The greatest threats to flow and temperature related barriers are irrigation withdrawals and management activities that degrade riparian habitat.

8.1.4 Lower John Day River Mainstem Tributaries Population

This population occupies the Lower John Day watershed. Steelhead spawning in the Lower John Day population area is in tributary streams connected by the John Day River. Important tributaries on the lower section of the John Day mainstem include West Bridge Creek, Butte Creek, Thirtymile Creek, Hay Creek and Rock Creek (NPCC 2005).

The subbasin contains 13 MaSAs and 22 MiSAs. The MaSAs include Bridge, Mountain, Cottonwood, Ferry, Middle Rock, Upper Rock, Pine Hollow, Lone Rock, Rock (Lower John Day), Thirtymile, Butte, Service, and Kahler. MiSAs include Emigrant Canyon, Spanish Hollow, Frank Fulton Canyon, Esau Canyon, Grass Valley, Scott Canyon, Jackknife, Pine (John Day), Rhodes Canyon, Bologna, Rowe, Currant, Johnson (John Day), Shoofly, Girds, Cherry, Buckhorn, Cottonwood Canyon, French Charlie, Lower Rock (Gilliam County), Hay and Haystack. Spanish Hollow and Frank Fulton are MiSAs that are tributaries to the Columbia River just downstream of the John Day River. EDT identified 1,033.7 miles of stream occupied by Lower John Day steelhead population.

Habitat Factors

Habitat Complexity

Land cover in the lower John Day River watershed is predominately rangeland and cropland (ODA 2004). Floodplains and riparian areas have been extensively altered by agriculture, livestock grazing, transportation corridors, and other development. Channelization and streambank hardening are extensive, affecting channel conditions and dynamics.

The lower reaches of tributaries in many of the MaSAs and MiSAs for this population have had extensive channel modifications, habitat diversity and LWD is lacking, and overall habitat complexity is well below benchmark condition. Examples include lower Bridge, Mountain, Rock (Wheeler County), Cottonwood, Ferry Canyon, Pine Hollow, and Thirtymile. Conditions improve upstream in many of the streams that flow out of the Bridge Creek Wilderness including Bridge, Mountain, and Rock (Wheeler County), as well as Cottonwood Creek, which flows out of an inventoried roadless areas.

Kahler and Service creeks have low levels of LWD and overall habitat complexity. EDT identified habitat diversity as a medium priority limiting factor and key habitat quantity as a high priority. Ferry Canyon has an incised channel that is generally unstable, though conditions have improved recently. Pine Hollow has a pipeline buried in the channel for 6.6 miles, making the channel very unstable. Channel conditions in Thirtymile Creek are generally degraded, with low levels of LWD and habitat complexity. Habitat complexity in Butte Creek is generally higher, with rearing occurring throughout the system. Rock Creek (Gilliam County) channel conditions are degraded, with areas that have been channelized and low levels of LWD.

Sediment/Substrate Conditions

Of the five major watersheds evaluated in the John Day Subbasin Plan, the largest sediment impacts noted in the EDT model occurred in the Lower John Day watershed (NPCC 2005). EDT identified sediment as a high priority limiting factor in Bridge, Butte, Grass Valley, Muddy, Scott Canyon, Lower and Upper Rock (Gilliam County), Thirtymile, Pine Hollow, and Mountain creeks. Gravel imbeddedness was also identified as a significant limiting factor by EDT in the tributaries for this watershed.

Changes in Peak/Base Flows

The USGS-maintained gage at McDonald Ferry, Oregon at RM 21, the oldest gage in the subbasin, has been in operation since December 1904. The lowest recorded discharge from the McDonald Ferry station was zero cfs for part of September 2, 1966, August 15 to September 16, 1973, and August 13, 14 and 19-25, 1977. Peak flow at the McDonald Ferry gaging station is typically over 100 times greater than the lowest flows of the same year. From year to year, peak flows can vary as much as 300 to 700%. This portion of the watershed is prone to intense thunderstorms during summer months, which scoured channels down to bedrock during one event.

EDT outputs rate “Flow” as either a medium or low priority for restoration in 16 out of the 18 reaches in the Lower John Day. Flow is not a restoration priority for the lower John Day River McDonald Ferry reach since it is frequently inundated by backwaters from the John Day reservoir. However, the subbasin planning technical team considered flow restoration a higher priority for several reaches than where it ranked in EDT outputs. Flow restoration would likely improve several other limiting factors addressed by EDT including habitat complexity, space, and temperature.

According to NMFS 2005 (Report to Congress), water withdrawals, riparian corridor alterations, grazing, channel alterations, and wetland loses have all contributed to lower base flows. Low flows are below benchmark in the lower reaches of Bridge, Cottonwood, and Mountain creeks. Flows are also below benchmark in Ferry Canyon, Pine Hollow, Thirtymile, Lower Rock (Wheeler County), and Butte. Water diversions contribute to reduced summer low flows in most of these areas.

Water Quality

During the summer months from July to September, groundwater provides much of the base flow to the Lower John Day River (NPCC 2005). Elevated temperature is an important limiting factor for most stream segments for the Lower John Day population that are measured (ODA 2004). Table 8-1 provides data on 303(d) listed streams in the Lower John Day watershed.

BLM (1999) characterized temperature as “Not Properly Functioning” for all streams rated in the lower John Day. Other water quality constituents such as total phosphates, biological oxygen demand, and fecal coliform can also limit water quality during late summer when flows are the lowest and water temperatures are the greatest (Table 8-1). Severe streambank erosion and sedimentation exists in some tributaries to the mainstem. Sediment problems are often associated with changes in native plant communities as a result of wheat farming, grazing, and/or timber harvest activities in a number of watersheds including Lower Rock (Gilliam County), Pine Hollow, Grass Valley and Thirtymile. Total Maximum Daily Loads (TMDLs) are expected to be developed for this portion of the subbasin in 2006.

Table 8-1. Lower John Day watershed 303(d) listed stream segments and parameters of concern (ODEQ 2002 as cited in NPCC 2005).

Waterbody Name	Parameter	Waterbody Name	Parameter
Bear Creek	Temperature	John Day River	Temperature
Bridge Creek	Temperature	John Day River	Temperature
Gable Creek	Temperature	John Day River	Fecal Coliform
Grass Valley Canyon	Temperature	John Day River	Dissolved Oxygen
Henry Creek	Temperature	Nelson Creek	Temperature
John Day River	Fecal Coliform	Pine Creek	Biological Criteria
John Day River	pH	Sorefoot Creek	Temperature
John Day River	Temperature	Stahl Canyon	Temperature
John Day River	Temperature	Thirtymile Creek	Temperature
		Thirtymile Creek	Temperature

Cottonwood, Rock (Wheeler Co) and Bridge have good quality water in their upper reaches, but water quality conditions, especially temperature, degrade in the lower reaches. Butte Creek has water quality that supports rearing throughout the stream.

Habitat Access

EDT identified "Obstructions" as a high priority limiting factor in Bridge, Kahler, Muddy, Lower Rock (Gilliam County), and Thirtymile creeks, and medium priority in Rock Creek (Wheeler County). The passage barrier on Bridge Creek is near the town of Mitchell and is considered passable to adults. The passage barrier on Kahler Creek is low in the system and considered only a juvenile barrier. A number of irrigation diversions create passage barriers on Lower Rock Creek (Gilliam County). Some of these have been repaired, but others have not. A fish passage structure was installed recently on Thirtymile Creek. None of the passage barriers identified are complete barriers except for the one on Muddy Creek. ODFW biologists also identified passage problems on Mountain Creek (Unterwegner 2005).

Many irrigation diversions occur within the John Day basin watershed and, in low-water years, fish may encounter passage and spawning difficulties in some tributary reaches due to these diversions. Flows necessary for migration may be unavailable during early summer months and low-flow conditions may limit the use of some potential spawning areas. (NOAA 2003-Bridge Creek Fish Passage and Irrigation Improvement Projects, West Fork Bridge Creek, Lower John Day River Subbasin, Wheeler County, Oregon).

Riparian/Large Wood Conditions

Riparian conditions have been degraded by various development activities including agriculture, grazing, stream channelization, and riparian roads and other infrastructure development. EDT rated riparian habitat improvements as "high" to "very high" priorities for restoration in all reaches of the lower John Day watershed.

Various reaches of Lower Rock (Gilliam County), Kahler, Service, Pine Hollow, and Thirtymile have very poor riparian conditions. Riparian conditions are fairly good in the Bridge Creek Wilderness areas of Bridge, Mountain and Rock (Wheeler County) creeks and in the inventoried roadless area of Cottonwood Creek. Ferry Canyon and Pine Creek also have good riparian cover in many reaches. Butte has generally fairly good riparian cover, except for isolated areas with poor conditions.

Limiting Factors

The top limiting factors for this population are: 1) Key habitat quantity, 2) Sediment Load, 3) Temperature, 4) Habitat Diversity, and 5) Flow. The primary limiting factors identified by the John Day Subbasin Plan (NPCC 2005) for this population are shown in Table 8-2. Obstructions are high priority limiting factors in Bridge, Kahler, Muddy, Rock (lower in Gilliam County), and Thirtymile creeks.

Table 8-2. EDT Diagnostic Report - Lower John Day Steelhead (NPCC 2004).

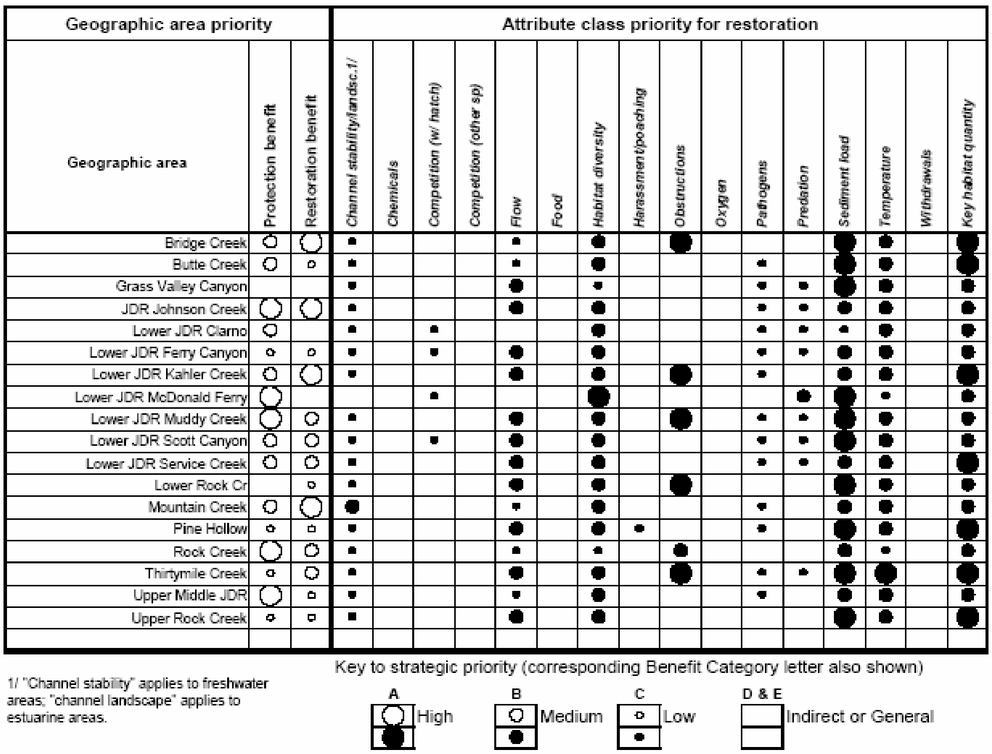


Table 8-3 presents the top quartile of the 18 HUC5s identified by the EDT model as important to this population for restoration and protection. One HUC5 (JDR Johnson Creek) is in the top quartile for both protection and restoration. Common restoration priorities for all four top priority HUC5s include Key habitat quantity, Temperature, Sediment load, and Habitat diversity. Upon reviewing the restoration attributes by geographic area, the subbasin technical team thought that flow restoration was also important for Bridge Creek, though probably not as important for Johnson Creek (NPCC 2005).

Table 8-3. Top Quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT(black), with additional attributes listed by subbasin planners (gray) for lower John Day steelhead (from NPCC 2005).

Lower John Day Summer Steelhead									
Geographic area priority			Attribute for Restoration						
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Flow	Habitat diversity	Obstructions	Sediment load	Temperature	Key habitat quantity
Bridge Creek		X							
JDR Johnson Creek	X	X							
Lower JDR Kahler Creek		X							
Lower JDR Muddy Creek	X								
Mountain Creek		X							
Rock Creek	X								
Upper Middle JDR	X								

Life Stages Affected

Low summer flows, elevated stream temperatures, and simplified and channelized streams have all reduced the quality and quantity of available rearing habitat for juvenile steelhead. Conditions now favor native and non-native salmonid predators. EDT modeling identified excessive fine sediments as a significant limiting factor in almost all Lower John Day HUC5s. Fine sediment inputs and embedded substrates can reduce incubation success.

Viability Parameters Affected

Low streamflows, elevated stream temperatures, and loss of habitat complexity all reduce rearing success for the fry to smolt life stage and lead to reduced freshwater productivity and abundance. High sediment loads reduce egg-to-fry survival in many of this population's MaSAs, reducing productivity and abundance. These same conditions may limit the spatial distribution of adults and juveniles to areas in the upper watersheds where temperatures, flow, and substrates are closer to preferred ranges. Likely, all the historical life-history strategies are still available; however, one-year smolts are present at a much reduced level.

Threats

Anthropogenic threats associated with the limiting factors for Lower John Day steelhead include agricultural and grazing practices, removal of overstory trees and bank vegetation from the riparian corridor, water withdrawals, wetland draining and conversion, and stream channelization and diking.

Rock Creek (Gilliam County), was historically a major producer of steelhead, but is not as productive today. A significant amount of the native grasses in the watershed have been converted to wheat fields and the headwaters have been heavily logged, resulting in the scouring of the streambed, channel modifications, lower flows, higher stream temperatures, and elevated sediment levels.

Pine Hollow MaSA has also had an extensive amount of its native plant community altered by livestock grazing and large portions of perennial grasses have been displaced by dryland wheatfields. Flow in many of the lower reaches is intermittent and the area is heavily grazed.

8.1.5 North Fork John Day River Population

The North Fork John Day (NFJD) is the largest tributary to the John Day River. The watershed drains approximately 1800 mi^2 (NPCC 2005). Much of this Upper North Fork watershed is in the Wilderness Area. There is a large diversity in the habitat conditions within the watershed, from high-elevation forested areas to dryer lowlands.

The North Fork John Day population contains 10 MaSAs, and five MiSAs (Table 8-4). EDT identified 885.6 miles of stream occupied by steelhead throughout the life cycle within the North Fork John Day River basin.

Table 8-4. Spawning areas for North Fork John Day Steelhead.

MaSA_NAME	TYPE
Lower Camas (NF John Day)	MaSA
Potamus	MaSA
Big Wall	MaSA
Big (NF John Day)	MaSA
Upper NF John Day	MaSA
Desolation	MaSA
Granite (John Day)	MaSA
Cottonwood (NF John Day)	MaSA
Owens	MaSA
Upper Camas (NF John Day)	MaSA
Stony	MiSA
Lower NF John Day	MiSA
Cabin	MiSA
West Fork Meadow	MiSA
Rudio	MiSA

Habitat Factors

Habitat Complexity

In general, most indicators of channel condition within the North Fork John Day River are "functioning at risk" (FAR)(NMFS 2004/0008). The North Fork River does not meet PACFISH pool frequency management objectives (USDA and USDI 1994 as cited in NPCC 2005). Key habitat quantity is identified by the EDT analysis as the most important limiting factor to address for this population

Specific information on indicators of channel condition is available in various NMFS Biological Opinions. Floodplain connectivity was rated as NPF in locations of the Granite Creek subwatersheds by the Wallowa Whitman National Forest (WWNF) due to the presence of dredge piles from historic mining operations. Many of these historic dredge piles are positioned very near the stream and prevent the stream from overflowing into the floodplain during high flow events. Pool frequency and quality were FAR in the Granite Creek subwatershed and NPF in upper North Fork subwatersheds. Large pools, off-channel habitat, wetted width/maximum depth ratio, and streambank condition were rated as PF in the Granite Creek subwatershed.

In the Big Wall Creek subwatershed indicators of channel condition are largely NPF or FAR (NMFS OHB2001-0118-FEC). Middle Camas and lower Owens creek watersheds have good potential; however, stream channels are incised, LWD is low, and habitat diversity is limited.

Sediment/Substrate

Wissmar et al. (1994) noted that turbidity in Cottonwood Creek, a tributary to the North Fork, is notoriously high after storm events. The resulting siltation of stream beds decrease aquatic insect production and degrades spawning beds.

WWNF noted that sediment was FAR in both the Granite Creek and Upper North Fork John Day subwatersheds. The Umatilla National Forest (UNF) noted that sediment was NPF and that substrate embeddedness was FAR in the Big Wall Creek subwatershed (NMFS OHB2001-0118-FEC). Big Wall Creek was listed on the 303(d) list for sediment. Sediment modeling conducted for the parts of the Big Wall Creek subwatershed indicates that recent timber harvesting activities in the action area are still affecting water quality through the addition of sediment to local streams (NMFS OHB2001-0118-FEC).

Changes in Peak/Base Flows

EDT identifies flow as a medium priority restoration need in Cottonwood Creek. Granite, upper and lower Camas, and lower North Fork were identified as low restoration priorities.

Water yield is generally close to benchmark conditions in most of the upper reaches and tributaries to the North Fork John Day. Low flows are more a problem in the lower elevation tributaries to the west including the lower reaches of Big Wall, Cottonwood, and Rudio.

The Pete Mann ditch system, in the Granite Creek watershed, is a complex of ditches originally constructed in the late 1800s to deliver water to local mines. Currently, the ditch system delivers water to both mines and land irrigated for agriculture. The Pete Mann ditch system often completely diverts Lightning Creek, Salmon Creek, and the East Fork Clear Creek (all MCR steelhead streams) into the Burnt River basin, a non-anadromous basin. Although the Forest Service did not rate change in peak/base flows, it is likely that this indicator is functioning either "at risk" or "not properly functioning" due to the presence of this ditch system.

Water Quality

The North Fork has the best chemical, physical, and biological water quality in the John Day Subbasin as compared to ODEQ water quality standards (USDI 2000 as cited in NPCC 2004). Most of the streams in this subbasin are considered in relatively good condition, with the exception of elevated late summer water temperatures that do not meet ODEQ standards. Temperature is a primary water quality limitation for streams in the NFJD watershed (Table 8-5), especially in Cottonwood Creek. WWNF also rated temperature as FAR in the upper North Fork John Day and the lower reaches of Granite Creek. Because the North Fork (including its primary tributary, the Middle Fork) contributes 60% of the flow to the mainstem John Day (OWRD 1986), the influence of the North Fork on temperature is significant, which relates directly to fisheries.

Other water quality problems in the North Fork include leaching of toxic mine waste and a high degree of stream sedimentation from highly erodable soils. Although the WWNF rated chemical contaminants/nutrients as FAR in the upper North Fork John Day and Granite Creek subwatersheds, waste from abandoned mine sites may be having serious negative effects on water quality in these areas. ODFW biologists have observed dead fish and adult fish with gill lesions in the streams of these watersheds (NMFS 2004/0008, Wilson, 2005). Although the cause of this mortality is not certain, elevated iron and heavy metal concentrations may be a contributing factor. Although recent surveys conducted by the UNF and U.S. Environmental Protection Agency (EPA) indicated that mercury was not present in high enough concentrations known to cause these types of effects, conditions at abandoned mine sites and abatement ponds may change yearly, increasing the amount of heavy metals released (NMFS 2004/0008). Hot geothermal springs also exist, but their effects on water quality are not fully known (NPCC 2005).

Table 8-5. North Fork John Day River watershed 303(d) listed stream segments and water quality parameters of concern (ODEQ 2002 as cited in NPCC 2004).

Waterbody Name	Parameter	Waterbody Name	Parameter
Alder Creek	Sedimentation	Hidaway Creek	Temperature
Baldy Creek	Sedimentation	Hog Creek	Sedimentation
Bear Wallow Creek	Temperature	Indian Creek	Temperature
Beaver Creek	Temperature	Lane Creek	Temperature
Big Creek	Temperature	Mallory Creek	Temperature
Big Wall Creek	Temperature, Sedimentation	Meadow Creek	Temperature
Bowman Creek	Temperature	North Fork Cable Creek	Temperature
Bridge Creek	Temperature	North Fork John Day River	Temperature
Buck Creek	Temperature	Onion Creek	Temperature
Bull Run Creek	Temperature	Owens Creek	Temperature
Cable Creek	Temperature	Porter Creek	Sedimentation
Camas Creek	Temperature	Potamus Creek	Temperature
Clear Creek	Temperature	Rancheria Creek	Temperature
Cottonwood Creek	Biological Criteria	Skookum Creek	Temperature
Crane Creek	Temperature	South Fork Cable Creek	Temperature
Desolation Creek	Temperature	South Trail Creek	Temperature
Ditch Creek	Temperature	Sponge Creek	Temperature
East Fork Cottonwood Creek	Biological Criteria	Stalder Creek	Temperature
Fivemile Creek	Temperature	Swale Creek	Temperature, Sedimentation
Frazier Creek	Temperature	Trail Creek	Temperature
Granite Creek	Temperature, Sedimentation	Wilson Creek	Temperature, Sedimentation

Habitat Access

EDT identified the Big Creek subwatershed as the only area where obstructions are considered a limiting factor, though this is a natural barrier. UNF rated physical barriers as FAR in the Big Wall Creek subwatershed (NMFS OHB2001-0118-FEC), as did the WWNF in the Granite Creek subwatershed.

Riparian/Large Wood Conditions

There is some general information on riparian conditions in the Granite Creek and Big Wall Creek subwatersheds of the North Fork John Day River. The UNF rated riparian conditions as FAR in the Big Wall Creek watershed. The WWNF also rated riparian conditions as FAR in Granite Creek. The Upper Nork Fork subwatershed was not rated, but most of the area is in Wilderness designation and likely at or near benchmark conditions. Access and road densities are very limited in Potomous, Big Wall, and Stony watersheds, and riparian conditions are likely near benchmark conditions too.

Limiting Factors

The limiting factors that are common to all North Fork John Day HUC5s (Cottonwood, Desolation, Granite, Lower Camas, Big, Potamus, Upper Camas, and Wall creeks, and the lower and upper North Fork) are key habitat quantity and sediment load. Temperature is a factor in all

HUC5s but Granite Creek and habitat diversity is a factor in all HUC5s but Desolation Creek. Flow and channel stability are frequently identified limiting factors.

Table 8-6 (NPCC 2005) provides information from EDT Diagnostic Report on limiting factors for each HUC5 occupied by the NFJD steelhead population. The limiting factors that are common to all North Fork John Day HUC5s (Cottonwood, Desolation, Granite, Lower Camas, Big, Potamus, Upper Camas, and Big Wall creeks, and the lower and upper North Fork John Day) are key habitat quantity and sediment load. Temperature is a factor in all HUC5s but Granite Creek and habitat diversity is a factor in all HUC5s but Desolation Creek. Flow and channel stability are frequently identified limiting factors.

When all HUC5s used by the population are considered, key habitat quantity, habitat diversity, sediment load, temperature, and to a lesser degree flow are common limiting factors for this population.

Table 8-6. EDT Diagnostic Report - North Fork John Day Steelhead (NPCC 2005).

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc. 1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Cottonwood Creek		A	C				B		B				C		A	A		A
Desolation Creek	A	B													B	C		B
Granite Creek	B	B	C				C		C						B			B
Lower Camas Creek	C	C	C				C		B						B	C		B
Lower JDR Clarno	C								C					C				B
Lower JDR Ferry Canyon	C	C							C					C				B
Lower JDR Kahler Creek	C								A					C		C		B
Lower JDR McDonald Ferry	A	C							C					B				
Lower JDR Muddy Creek	B								B					C		C		B
Lower JDR Scott Canyon	C								C					C				B
Lower JDR Service Creek	C								B					C	C	C		B
Lower NF JDR	B	B	C				C		B				C		B	B		B
NF JDR Big Creek	A	A	C						C		B				C	C		B
NF JDR Potamus Creek	A	A					C		B						B	B		B
Upper Camas Creek	A	C	C				C		C						B	C		B
Upper NF JDR	A	A	C						C						B	C		B
Wall Creek	B	B					B		C						B	B		B

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A High

B Medium

C Low

D & E Indirect or General

Life Stages Affected

Habitat diversity, flow and temperature are identified as either medium or low priority restoration needs in almost all North Fork MaSAs, suggesting the parr to smolt survival may be reduced. Excessive fine sediment would likely have the greatest impact on egg to fry survival. Toxic leaching may be having adverse effects on all life stages of steelhead in Granite Creek and the North Fork John Day River.

Viability Parameters Affected

Reductions in amount and quality of juvenile rearing habitat likely affect juvenile rearing (fry to smolt) life stages, and subsequently, freshwater productivity and abundance. The leaching of toxic mine waste and a high degree of stream sedimentation from highly erodable soils could also have significant effects on productivity and abundance. Elevated water temperatures, and channel alterations and obstructions have likely slightly altered the spatial distribution and structure of the population; however, it still should generally reflect benchmark conditions.

Threats

Anthropogenic threats associated with these limiting factors are riparian disturbance, stream channelization and relocation, grazing, timber harvest, road building, irrigation withdrawals, mining, and dredging (NMFS 2004).

Mining has had significant effects on various parts of the North Fork watershed. The watershed has been mined extensively in the past and some mining operations are occurring at the present time. Livestock management practices in lower elevation tributaries and select reaches of the mainstem North Fork have reduced riparian vegetation, and caused bank destabilization and excessive sedimentation. Within the lower Cottonwood, Rudio and Deer creek drainages as well as the Camas Creek basin, pushup dams, used for irrigation, have created intermittent passage barriers, increased sedimentation, reduced flows, altered channels alteration, and resulted in water quality impacts. Additionally, some water diversions are not properly screened to prevent intake of juvenile MCR steelhead (NMFS 2004). Ground-based logging and high road densities have increased sediment delivery to some streams.

8.1.6 Middle Fork John Day River Population

The Middle Fork John Day subbasin contains five watersheds, which are occupied by steelhead. EDT identified 366.1 miles of stream occupied by steelhead**.** There are four MaSAs for the Middle Fork John Day population, including Long Creek, Slide Creek, Rush Creek, and Upper Middle Fork John Day, and two MiSAs including Camp Creek and Cole Canyon.

Comment [T. U.1]: I don't understand how Rush Creek can be a MaSA and Camp Creek is a MiSA. Camp Creek may be the largest spawning tributary to the Middle Fork (rivals Long Cr). Rush Creek has marginal habitat and although Slide Creek and Rush Cr HUC 5s may be larger the actual stream mileage used by steelhead is much smaller than Camp.

Habitat Factors

Habitat Complexity

Tributaries to the Middle Fork that flow out of the Dixie divide between the Middle Fork John Day and the Upper John Day are generally steep and incised in the lower reaches. Long, Squaw and Camp creeks flow through low-gradient meadow systems in the upper reaches. Tributaries that flow out of the Elkhorn Mountains to the north do not generally have meadow systems in their upper reaches, and the base rock is granitic.

Entrenched channels have become disconnected from their floodplains in areas of the Middle Fork John Day watershed (MNF 1999). Several areas within the watershed with very wide grassy valley bottoms that historically were likely Rosgen E-channels have been altered to type G and C channels by past overgrazing and road construction within floodplains (MNF 1999). Known areas with this condition include Mainstem Middle Fork John Day River, Squaw Meadow, Summit Creek and Squaw Creek at their confluence with the Middle Fork, and Olmstead Creek at Olmstead meadows. Portions of Bridge, Dry Fork Clear, Crawford, Summit, and Squaw creeks have significant lengths of their channels impacted by streamside roads. Dredge mining has completely altered the valley bottom and stream channel in many parts of the watershed (MNF 1999). EDT identifies habitat diversity and key habitat quantity as limiting factors in all major and minor spawning areas.

Mining operations have altered many of the stream channels and floodplains along the Middle Fork and its tributaries. Alterations have occurred along Elk, Davis, Deep, Vinegar, Placer Gulch, Vincent, Caribou, Beaver, Granite Boulder, Big Boulder, Ragged, Butte, Ruby, and the Middle Fork mainstem. Some of the meadow areas have incised channels, including Phipps Meadow. Road construction has altered and constricted channels in many tributaries and along the Middle Fork mainstem. Log weirs, placed in lower Camp Creek, keep the channel from reestablishing its natural morphology.

Sediment/Substrate

The BLM identified sediment/turbidity and substrate embeddedness as functioning at risk (FAR) in the Middle Fork John Day and a number of its tributaries (NMFS 2004/00383). The EDT model identifies sediment loading as a significant limiting factor in the watershed. Excessive fine sediment problems are generally located in the Middle Fork mainstem (Unterwegner and Neal 2005). Poor riparian conditions, riparian roads, grazing activities, and past forestry, mining, and channel alterations all contribute sediment to streams in the watershed.

Changes in Peak/Base Flows

The area is susceptible to rain-on-snow events capable of producing high volume, short duration run-off surges during the late winter and early spring months. Late season base flows are sustained by slow release of water from the soil matrix, effluent groundwater, numerous wet meadows, and perennial springs (MNF 1999). Where channels have become entrenched water tables are lowered and water storage capacity is reduced, resulting in lower base flows.

While low flows are a problem throughout the subbasin, irrigation withdrawals are not as significant as for some other populations in the John Day MPG, nor as significant as they were a few years ago. The majority of water rights in the upper Middle Fork subbasin are no longer being used for irrigating pastures. Four of the five largest water users above Highway 395 have converted their consumptive rights to instream rights for either the entire year or for the most critical low flow period. There are three properties in the Middle Fork subbasin above Highway 395 that continue to irrigate pastures with flood irrigation. One of these properties is located on Camp Creek, one is on the Middle Fork immediately above Camp Creek, and the other is near Galena.

Water Quality

Water quality in the Middle Fork subbasin generally exhibits satisfactory chemical, physical, and biological quality as compared to ODEQ water quality standards (USDI 2000 as cited in NPCC 2005). The Middle Fork John Day usually has worse water quality problems than its tributaries, with the most serious water quality problem being elevated summer temperatures. Season-long cattle grazing contributes to elevated fecal coliform counts during summer. However, agricultural runoff presents a low level of potential impact to water quality (NPCC 2001 as cited in NPCC 2005). Bates Pond, an old mill pond on Bridge Creek located less than 200 yards from its confluence with the Middle Fork, likely adds to temperature problems in the Middle Fork.

ODEQ has identified several streams in the Middle Fork watershed as water quality limited for high temperatures, dissolved oxygen, or biological criteria, with the most serious water quality problem being elevated summer temperatures caused by vegetation disturbance, stream straightening/relocation, livestock grazing, timber harvest, road building, irrigation water withdrawals, and historical mining and dredging (NPCC 2005). Table 8-7 provides data on listed stream segments in the Middle Fork watershed.

Table 8-7. Middle Fork John Day River watershed 303(d) listed stream segments and parameters of concern in 1998 and 2002 (ODEQ 2002 available at http://www.deq.state.or.us/wq/WQLData/SubBasinList02.asp).

Waterbody Name	River Mile	Parameter	Season	List Date
Big Creek	0 to 11.6	Temperature	Summer	1998
Camp Creek	0 to 15.6	Temperature	Summer	1998
Caribou Creek	0 to 3.6	Temperature	Summer	1998
Clear Creek	0 to 12.7	Temperature	Summer	1998
Coyote Creek	0 to 2.5	Temperature	Summer	1998
Crawford Creek	0 to 3.5	Temperature	Summer	1998
Davis Creek	0 to 6.8	Temperature	Summer	1998
Dry Fork Clear Creek	0 to 11	Temperature	Summer	1998
Granite Boulder Creek	0 to 8.1	Temperature	Summer	1998
Little Boulder Creek	0 to 2.1	Temperature	Summer	1998
Little Butte Creek	0 to 2.6	Temperature	Summer	1998
Long Creek	0 to 36.7	Temperature	Summer	1998
Lunch Creek	0 to 4.1	Temperature	Summer	1998
Middle Fork John Day River	0 to 69.8	Temperature	Summer	1998
Middle Fork John Day River	0 to 69.8	Temperature	August 15 - July 15	2002
Mill Creek	0 to 3.1	Temperature	Summer	1998
Placer Gulch	0 to 4.2	Temperature	Summer	1998
Ragged Creek	0 to 4.1	Temperature	Summer	1998
Squaw Creek	0 to 9.4	Temperature	Summer	1998
Summit Creek	0 to 8.6	Temperature	Summer	1998
Summit Creek	0 to 8.6	Temperature	August 15 - July 15	2002
Unnamed Waterbody	0 to 2.4	Temperature	Summer	1998
Vinegar Creek	0 to 7.1	Temperature	Summer	1998

Poage et al. (1996) studied stream temperatures along the length of the Middle Fork John Day River and found they were quite different than other subbasins of the John Day River. The average stream temperature profile for the Middle Fork John Day River indicated that the pattern of water temperature was highly variable (Figure 8-1) (Poage et al. 1996). The highest average water temperatures were observed at the upstream end of the 60 km study section (Figure 8-1). The authors hypothesized that the decrease in downstream temperature can be explained by cold-water inputs from cooler tributaries (e.g., the confluence of Clear Creek at river km 50), and as the result of relatively cool groundwater seeping into the main stream channel. The gradual downstream decrease in stream temperature occurred even though the river flows through a relatively wide and unshaded valley between river kms 45 and 40. Although a downstream increase in stream temperature is normally associated with a lack of vegetative shading, they hypothesized that the observed downstream temperature decrease is due to progressively increasing amounts of relatively cooler groundwater flowing into the main stream channel (Poage et al. 1996).

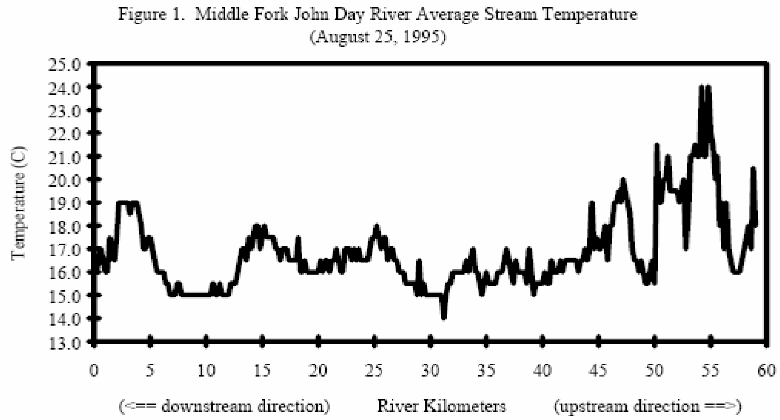


Figure 8-1. Average stream temperature in the Middle Fork John Day River (August 25, 1995).

Habitat Access

EDT does not identify any areas where obstructions are priority restoration needs. MNF conducted a culvert inventory that should provide additional information on barriers. A number of forest service culverts form partial passage barriers (Unterwegner 2005).

In the past, numerous pushup dams and irrigation diversions in the upper Middle Fork and several of its tributaries created intermittent passage barriers, increased sedimentation, seasonally reduced flows, altered channels, and caused other water quality impacts. Within the last ten years, many of these irrigation diversions have been converted to permanent, more fish passage friendly structures. Because these structures are permanent, there is no longer a need for the water user to do instream channel work. The structures provide fish passage year long and at all stream flows, and they enable the water user to more accurately measure the amount of water diverted. Additionally, four of the five largest water users above Highway 395 have converted their consumptive rights to instream rights for the entire year or for the most critical low flow period. There may be water diversions that are not properly screened to prevent intake of juvenile MCR steelhead particularly on Long Creek and other tributaries of the lower Middle Fork (NPCC 2001 cited in NMFS 2004).

Riparian/Large Wood Conditions

Riparian corridors and levels of instream LWD have changed significantly from historic conditions. The reduction in large wood has resulted in fewer pools, increased stream velocities, reduced sediment trapping, and an overall reduction in channel diversity and key habitat (MNF 1999). Exceptions include the Clear Creek and Lunch Creek watersheds which contain high levels of woody material and good riparian conditions. Weir "hard structures" have been constructed in Squaw, Summit, Phipps, Dry Fork Clear creeks, and the lower portion of Clear Creek in an attempt to increase pool habitat and instream diversity (MNF 1999).

Limiting Factors

The limiting factors that are common to all Middle Fork John Day HUC5s (Big, Camp, and Long creeks, and lower and upper Middle Fork) are Key habitat quantity, Habitat diversity, Flow, and Sediment load. Temperature is limiting in all HUC5s but the upper Middle Fork.

Table 8-8 (NPCC 2005) provides information from EDT Diagnostic Report on limiting factors for each HUC5 occupied for the Middle Fork John Day steelhead population. The limiting factors that are common to all Middle Fork HUC5s (Big, Camp, and Long creeks, and lower and upper Middle Fork) are Key habitat quantity, Habitat diversity, Flow, and Sediment load. Temperature is limiting in all HUC5s but the upper Middle Fork John Day.

When all HUC5s used by the population are considered, Key habitat quantity, Habitat diversity are common limiting factors in almost all HUC5s. Sediment load and Temperature are less common but still frequently occur.

Table 8-8. EDT Diagnostic Report – Middle Fork John Day Steelhead (NPCC 2005).

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	*Channel stability/landsc. 1/*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Big Creek	◯	◯	•				•		•						●	•		●
Camp Creek	◯	◯					•		•						●	•		●
Long Creek	◯	◯	•				●		●						●	•		⬤
Lower JDR Clarno	∘	∘							•					•				●
Lower JDR Ferry Canyon		∘							•					•				●
Lower JDR Kahler Creek	○								⬤					•		•		●
Lower JDR McDonald Ferry	○	○							•					●				
Lower JDR Muddy Creek	∘								●					•		•		●
Lower JDR Scott Canyon		∘							•					•				●
Lower JDR Service Creek	○	∘							●					•	•	•		●
Lower MF JDR	○	◯	•				•		●						●	●		●
Lower NF JDR	∘	○							•							●		●
NF JDR Potamus Creek		○							●							●		•
Upper MF JDR	◯	◯	•				•		•						●			●

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A		B		C		D & E	
◯	High	○	Medium	∘	Low		Indirect or General
⬤		●		•			

According to the John Day Subbasin Plan; "Among the 14 HUC5s denoted by EDT as important to the Middle Fork John Day steelhead population, all five HUC5s in the top restoration and protection quartiles are within the Middle Fork watershed (Table 8-9). Three of the geographic areas (Big Creek, Camp Creek, and Long Creek) are listed as high priority for both protection and restoration, signifying that all three should be protected from further degradation and that restoration on any of the limiting factors listed would have the potential to increase productivity and abundance for the population.

Common attributes to all five top priority HUC5s for restoration is Key habitat quantity and Sediment load. Upon review, the John Day technical team thought that habitat diversity and temperature were important attributes for restoration for Camp Creek. The John Day technical team was dubious of the protection value for Long Creek.

Table 8-9. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT (black), with additional attributes listed by the subbasin planners (gray) for Middle Fork John Day summer steelhead (adopted from the NPCC 2005).

MF John Day Summer Steelhead							
Geographic area priority			Attribute for Restoration				
Geographic area	Protection benefit	Restoration benefit	Flow	Habitat diversity	Sediment load	Temperature	Key habitat quantity
Big Creek	X	X			■		■
Camp Creek	X	X		▒	■	▒	■
Long Creek	X	X	■	■	■		■
Lower MF JDR		X		■	■	■	■
Upper MF JDR	X				■		■

Life Stages Affected

Habitat diversity, flow and temperature are identified as either medium or low priority restoration needs in all Middle Fork John Day MaSAs which would lead to reductions in fry to smolt survival. All life stages could be adversely affected by the lack of habitat complexity, especially fry to smolt life stages. Excessive fine sediment in the mainstem Middle Fork would likely have the greatest impact on egg-to-fry survival, though the mainstem is not a major spawning area for Middle Fork steelhead.

Viability Parameters Affected

The lack of habitat complexity, low streamflows, and elevated temperatures reduce the quality and quantity of rearing habitat for steelhead juveniles, reducing freshwater productivity and abundance. Excessive fine sediments may reduce egg-to-fry survival, though this is not expected to be a major problem for the population. The spatial structure and diversity of the population is likely altered somewhat by temperature extremes, the lack of habitat diversity, and channel alterations; however it should generally reflect benchmark conditions.

Threats

Anthropogenic threats associated with limiting factors for Middle Fork John Day steelhead include riparian disturbance, stream channelization and relocation, grazing, timber harvest, road building, passage barriers, irrigation withdrawals, mining, and dredging (NMFS 2004). Livestock and grazing management practices in the subbasin have reduced riparian vegetation, and caused bank destabilization, excessive sedimentation, and increased stream temperatures.

8.1.7 South Fork John Day River Population

Mid-Columbia River steelhead spawn, rear, and migrate through the lower South Fork John Day up to Izee Falls at (RM) 28.5, in Murderers Creek, and other South Fork tributaries. EDT identified 160.0 miles of stream occupied by steelhead in the South Fork drainage.

All three spawning areas identified for the South Fork John Day population are MaSAs. These include the Upper and Lower South Fork John Day, and Murderers Creek MaSAs.

Habitat Factors

Habitat Complexity

The loss of beavers, active LWD debris removal projects, road construction, riparian timber harvests, and poor grazing management accelerated water runoff and instream velocities (MNF 1997). These activities increased channel and bank erosion, with incised and unstable channels. The extent of floodplain connectivity has not been measured; however, ODFW considers this attribute as not properly functioning in sections of Murderers Creek below Cabin Creek. Current stream bank surveys on the lower 14.6 miles indicate that the banks of Murderers Creek are between 98 and 100% stable. A riparian fence, except for six water gaps used by cattle, protects the stream bank along this reach.

Stream surveys in 1960 (ODFW) and 1997 (MNF) determined that most reaches of Murderers Creek were deficient in large woody debris (LWD). The lower reaches of Murderers Creek are likely still deficient in LWD, but this condition is expected to improve as riparian vegetation recovers within the riparian fenced areas.

Habitat surveys, conducted during 1960, revealed 72% riffle area and 28% pool area in 23 miles of Murderers Creek. Few areas have deep pools because of the lack of LWD and beaver dams in the Murderers Creek watershed (MNF 1997). Today, pool habitat is closer to benchmark conditions in the South Fork than generally found in the tributaries (Unterwegner 2005). There is more beaver activity in the creek since 1960 and the riffle-pool ratio has likely improved. The average pool depth during the June 1960 survey was 2.5 feet for the 23 miles of stream.

Murderers Creek has a few braided channels and backwaters. New beaver dams are contributing to the off channel habitats. As the water drops in the summer, braiding and backwaters are reduced to the channel. During low water and periods of high stream temperatures, distribution of juvenile steelhead is limited to cool water areas.

Sediment/Substrate Conditions

Table 8-10 below provides data on sediment conditions in both pool and riffle habitats from 2004 properly functioning condition (PFC) assessments in the South Fork drainage conducted by the MNF (MNF 2004). Almost all of the measurements led to a "Not properly functioning" (NPF) determination for sediment in the South Fork and its tributaries. The MNF (2004) also noted that ongoing management of the existing road network associated with Reach 1 of Deer Creek is continuing to contribute excess gravel to the channel. The Forest Service lands within Deer Creek HUC5s have road densities of 4.14 miles of road/mile². This high road density may contribute to elevated sediment levels and embedded substrates in the South Fork John Day and its tributaries.

Table 8-10. PFC conditions of sediment in South Fork John Day tributaries (MNF 2004).

Area	Total readings	#PF	#AR	#NPF
SF John Day Tribs	27	2	1	24

PF=properly functioning; AR=at risk; NPF= not properly functioning

The MNF (2004) also collected substrate embeddedness data for 40 streams in the South Fork watershed that showed substantial problems with embeddedness throughout the watershed. Substrate was rated as Y or N depicting whether it was embedded >35% or not. The data was summarized to show the percentage of units with "Y" embeddedness within the areas. Each area was summarized to show the percentage of units that were > 35% embedded. Table 8-11 provides a summary of that data with the last column revealing the number of Units with >50% of their summaries showing 35% embeddedness in South Fork John Day River tributaries.

Table 8-11. South Fork John Day Embeddedness Summary (MNF 2004).

Area	Total Summaries	# with >50% of Unit Embedded
SF John Day Tribs	26	21

Roads might be the single most important management action causing the increases in sedimentation of streams (MNF 1997). Road densities on Forest Service lands in various HUC5s of the South Fork drainage are; 2.75 miles/mile² in Murderers Creek; 4.14 miles/mile² in Deer Creek; 4.25 miles/mile² in Middle South Fork; and 3.27 miles/mile² in Upper South Fork. The most heavily roaded areas are coincident with sedimentary soils in the upper watershed (MNF 1997). Surveys from 1992 to 1997 identified a number of reaches in the Murderers Creek watershed that were contributing excessive sediment to stream channels including, Beaver Creek and North Fork Beaver Creek, Miner Creek, Grapefruit Creek, Orange Creek, Charley Mack Creek, South Fork Murderers Creek, Bark Cabin Creek, Murderers Creek in the reach between Stewart's Cabin and Murderers Creek Guard Station, Oregon Mine Creek, and Tennessee Creek.

Changes in Peak/Base Flows

Tributaries such as Black Canyon are a source of good quality, cool water to the mainstem South Fork. John Young Meadows, in the upper South Fork Murderers Creek, was an area where beavers were very active historically. The loss of beavers in this meadow has reduced the water storage capacity and led to entrenched channels downstream of the meadows (MNF 1997, Unterwegner 2005). MNF (1997) describes the Murderers Creek watershed as having a higher density of springs than most of the Bear Valley Ranger District. However, many of the tributaries flow only intermittently during the summer (MNF 1997).

Livestock grazing, logging, road construction, and beaver removals have all contributed to changes in peak/base flows by compacting soils, reducing water storage, reducing riparian vegetation, straightening and incising channels, reducing ground cover and contributing to a conversion in dominant upland vegetative cover (ie switch from perennial grasses to annual grasses). Fire suppression has also contributed, allowing juniper encroachment on 1,000's of acres. Further, the South Fork John Day experienced considerable amounts of intensive stream channelization, flow modifications and drainage (including some tiling of drainage ditches) projects between 1943 and 1951. These projects, while encouraged and supported by various agencies, altered the routing and timing of water delivery to streams; often increasing peak flows and reducing summer low flows.

Irrigation withdrawals further reduce summer low flows. However, overall, water withdrawals and agricultural impacts in steelhead occupied reaches of the South Fork drainage are not as significant as in the Upper John Day or Lower John Day steelhead populations (Unterwegner 2005).

Low-flow conditions in Murderers Creek and other South Fork tributaries may limit the use of some potential spawning areas even in unaltered habitat due to the lack of water in early summer months. In some years, flows may fall below recommended levels for successful spawning in Murderers Creek as early as May (ODFW 2005-PWSWA BA). Water temperatures and unsuitable habitat associated with naturally occurring low water conditions in Murderers Creek likely alter or temporarily block movement of juveniles during summer months (ODFW 2005).

Water Quality

Elevated water temperatures during the summer months are considered a major limiting factor in the South Fork John Day River, Deer Creek, and Murderers Creek. Monitoring by the stream gage near the mouth of Murderers Creek shows that water temperatures exceed 64ºF, 54% of the time (65 days out of 122 days) between July 1 and September 30, averaged over the 5-year period (ODFW 2005). Elevated stream temperatures are also a problem in other major tributaries (Table 8-12). Water withdrawals and agricultural impacts above Izee Falls contribute to water quality problems in occupied reaches of the lower SFJD (Unterwegner 2005).

Table 8-12. South Fork John Day watershed 303(d) listed streams and parameters of concern (ODEQ 2002 adapted from NPCC 2005).

Water Body Name	***Parameter***
Deer Creek	Temperature
North Fork Deer Cr.	Temperature
Murderers Creek	Temperature
South Fork John Day	Temperature

Habitat Access

Izee Falls, at RM 28.5, is a complete natural block to steelhead migration. Water diversion structures, and thermal barriers can at times form passage barriers for juvenile steelhead. Irrigation withdrawals can contribute to problems with upstream adult migration during late spring during very low water years.

Riparian/Large Wood Conditions

Grasses, sagebrush, and juniper trees comprise approximately 42% of the Murderers Creek watershed, mostly located in southwest corner. Timbered areas comprise approximately 58% of the watershed and are located mainly in the MNF (MNF 1997). Riparian areas are typically managed as part of range operations, and many have been altered from their natural state by water diversions, channelization, vegetation changes and the like (NPCC 2005). Grazing activities on the forest and private lands have impacted riparian functions by reducing or eliminating native plant communities, altering soil conditions and infiltration rates (MNF 1997; Kauffman 2004). Private, state and Federal timber harvests have also altered riparian vegetation. These activities have reduced instream large wood concentrations and the potential for future large wood contributions.

The MNF (2004) measured LWD in the South Fork watershed. Out of 28 streams, 15 streams met NMFS criteria of >20 pieces per mile of LWD >35 feet in length. Reduced riparian functions lead to an overall decrease in habitat diversity (pool quality and quantity, cover, etc.).

Limiting Factors

Currently, forest stand conditions differ greatly from historical conditions, due to many years of grazing, fire suppression, and timber harvests in the Murderers Creek watershed. Vegetation disturbance, stream straightening/relocation, livestock grazing, timber harvest, road building, and irrigation water withdrawals have seriously degraded riparian and upland areas, water quality, and the hydrograph in the South Fork John Day and its tributaries (NMFS 2004). On BLM properties in the South Fork subbasin (2004 BLM BA for Grazing), 14 out of 19 baseline habitat indicators for steelhead were described as either “at risk” or “not properly functioning”. Five indicators were described as “properly functioning” including chemical contamination/nutrients, physical barriers, pool frequency, streambank condition, and disturbance history.

The primary limiting factors identified by the John Day Subbasin Plan (NPCC 2005) for the South Fork John Day population are shown in Table 8-13. These priorities were developed by subbasin technical teams using outputs from the EDT model.

The top limiting factors for this population are: 1) Key habitat quantity, 2) Habitat Diversity, 3) Flow, 4) Temperature, and 5) Obstructions. Three of the watersheds (HUC5s) rated in the EDT Diagnostic Report (Table 8-13) are within or tributaries to the South Fork John Day River, including lower South Fork, Middle South Fork, and Murderers Creek. The other areas are HUC5s downstream of the South Fork that are important for steelhead. The highest priority limiting factors common to the South Fork watershed and its tributaries include Sediment load and Key habitat quantity (both medium priorities). Temperature, Flow, and Habitat diversity are also identified as either medium or low priorities in these HUCs. The top limiting factors for this population when all downstream watersheds are included are Key habitat quantity and Habitat diversity. Temperature, Predation, and Sediment load are other factors that are common to most HUCs affecting the South Fork population (Table 8-13).

A Biological Assessment for the Murderers Creek subwatershed included a list of environmental parameters modified from the NMFS Matrix of Pathways and Indicators. The BA identified streambank condition, pool frequency, physical barriers, chemical/nutrients, and sediment as properly functioning. This assessment conflicts with EDT results and Malheur National Forest data that identify sediment as a more significant limiting factor in the South Fork. Temperature, large wood, off-channel habitat, floodplain connectivity, and peak/base flows were considered not properly functioning.

Table 8-13. EDT Diagnostic Report – South Fork John Day Steelhead.

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Fields Creek									●					•	•	•		⬤
JDR Johnson Creek	∘	◯							•					•	•	•		●
Lower JDR Clarno	∘	∘							•					•				●
Lower JDR Ferry Canyon		∘							•					•				●
Lower JDR Kahler Creek	∘	∘							⬤					•		•		●
Lower JDR McDonald Ferry	○	○							•					●				
Lower JDR Muddy Creek	○								•					•				●
Lower JDR Scott Canyon		∘							•					•				●
Lower JDR Service Creek	○	∘							●					•	•	•		●
Lower SF JDR	◯	◯					•		•						●	●		●
Middle SF JDR	◯	○					•		•						●	•		●
Murderers Creek	◯	◯					•		•						●	•		●
Upper Middle JDR		○							•					•	•	•		●

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A		B		C		D & E	
◯ / ⬤	High	○ / ●	Medium	∘ / •	Low	(blank)	Indirect or General

* Fields Creek, which is tributary to the JDR upstream of the SFJD, was included in the EDT analysis as part of the SFJD, but the TRT considers it a MiSA to the UJD population and it was discussed in the UJD population.

Table 8-14 lists the top quartile protection and restoration HUC5s for the South Fork steelhead population. Among the high priority HUC5s, two (Lower South Fork and Murderers Creek) are listed for both protection and restoration, signifying that both should be protected from further degradation and that restoration on any of the limiting factors listed would have the potential to increase productivity and abundance for the population. Common to all four top priority HUC5s is key habitat quantity, with three of the HUC5s also having sediment load as a priority. Upon review, the John Day technical team thought that temperature should be added as an attribute for restoration for the South Fork John Day River and Murderers Creek (NPCC 2005).

Table 8-14. Top Quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT(black), with additional attributes listed by subbasin planners (gray) for lower John Day steelhead (from NPCC 2005).

SF John Day Summer Steelhead						
Geographic area priority			Attribute for Restoration			
Geographic area	Protection benefit	Restoration benefit	Sediment load	Temperature	Key habitat quantity	
JDR Johnson Creek		X				
Lower SF JDR	X	X				
Middle SF JDR	X					
Murderers Creek	X	X				

Life Stages Affected

EDT modeling determined that Key habitat quantity and Habitat diversity are generally significant limiting factors in most South Fork HUC5s. Stream systems lack LWD, cover, quality pools, and other characteristics that are necessary to support freshwater lifestages for juvenile steelhead, as well as quality spawning habitat for adults. Elevated stream temperatures and low flows, found in the South Fork streams, further reduce the quality and quantity of habitat for juveniles rearing habitat in the John Day River and its tributaries. Elevated fine sediment loads and embedded substrates found in some streams also likely reduce spawning and incubation success.

Viability Parameters Affected

Productivity and abundance are likely the viability parameters most affected by changes in habitat conditions in the South Fork population. The reductions in cover, pools, LWD, and overall habitat diversity, combined with increased stream temperatures and reduced connectivity, likely has the greatest effect on fry to smolt survival. Lower egg-to-parr survival from sedimentation and embedded substrates also reduces freshwater productivity and abundance. It is unknown whether elevated stream temperatures and poor quality rearing habitat may have altered the distribution and spatial structure of the population; however, professionals familiar with the population believe that all the major life history traits are still represented in the population.

Threats

Anthropogenic threats associated with these limiting factors include riparian disturbance, stream channelization and relocation, grazing, timber harvest, road building, fish passage barriers (culverts, and other seasonal barriers), and irrigation withdrawals (NMFS 2004).

8.1.8 Upper John Day River Population

The Upper John Day River population has three MaSAs: Upper John Day, Beech, and Canyon. It also has four MiSAs: Laycock, Fields, Cummings, and Marks. The MaSAs are located primarily in the upper portions of the population's range, while the MiSAs are located in the lower reaches of the population's range in John Day River and tributaries. EDT identified 351.1 miles of stream occupied by steelhead in the Upper John Day subbasin.

Habitat Conditions

Habitat Complexity

Key habitat quantity was identified as either high or medium priority restoration need by the EDT model for all areas of the Upper John Day (UJD) Population (NPCC 2005). Habitat diversity was identified as either a medium or low priority restoration need in all Upper John Day reaches. In their Environmental Baseline for the Upper John Day, the Malheur National Forest (MNF) rated LWD conditions and potential recruitment as "functioning at risk" (MNF 2004). The levels of big LWD are well below benchmark conditions for all areas outside the Wilderness boundaries (Unterwegner 2005 per. communication). Grazing has altered or removed native riparian vegetation, which has led to reduced streambank stability, and increased sediment loads and width/depth ratios (MNF 1999). Beech, Laycock, Fields, and Strawberry creeks are areas where restoration needs are highest for key habitat quantity and habitat diversity. Removal of beaver and their associated dams has reduced habitat complexity, floodplain function, and the amount of stored water. Livestock grazing has contributed to increased channelization, reductions in LWD, cover and bank stability, particularly in lower reaches of tributaries.

Sediment/Substrate Conditions

Canyon Creek has a plentiful supply of spawning gravels. Most of the good spawning habitat occurs in the upper reaches in meadow type habitats.

Substrate embeddedness data was collected for 40 streams in the Upper John Day watershed. Substrate was rated as Y or N depending upon whether it was embedded >35% or not. The data was summarized to show the percentage of units with "Y" embeddedness within the areas. Each area was summarized to show the percentage of units that were > 35% embedded. Table 8-15 provides a summary of that data with the last column revealing the number of streams with >50% of their summaries showing >35% embeddedness. Substrate embeddedness is a problem for all but three of the eight Canyon Creek reaches measured, and 10 of the 32 mainstem John Day reaches measured.

Table 8-15. Upper John Day Embeddedness Summary.

Area	Total Summaries	# with >50% of Units Embedded
Aldrich Front Range Tribs (Laycock &Fields MiSAs)	6	2
Canyon Cr. Tribs (MaSA)	8	5
Mainstem John Day	32	10

Changes in Peak/Base Flows

The upper John Day River experienced intensive stream channelization, flow modifications and drainage (including some tiling of drainage ditches) projects between 1943 and 1951. These projects were encouraged and supported by various agencies to improve crop production. This work was accomplished as "a conservation priority and was considered the stream science at the time" (ODA 2002 as cited in NPCC 2005).

These activities have altered the routing and timing of water delivery to streams; often increasing peak flows and reducing summer low flows. Irrigation withdrawals further reduce summer low flows, especially considering that the vast majority of the irrigation is from surface waters of the John Day and its tributaries (NPCC 2005). Livestock grazing, logging, road construction, and beaver removals have all contributed to changes in peak/base flows by compacting soils, reducing water storage, reducing riparian vegetation, straightening and incising channels, reducing ground cover and contributing to a conversion in dominant upland vegetative cover (i.e. switch from perennial grasses to annual grasses). Fire suppression, which has allowed juniper encroachment on 1,000's of acres, also contributed to altered flow regimes.

Summer low streamflows are below what would have existed historically. Streamflows in the upper John Day have been modified by irrigation diversions (MNF 2004 grazing Environmental baseline). Water withdrawals dewater the lower reaches of Pine, Strawberry, Indian, Riley, Moon, McClellan, Laycock, and Fields creeks. Grazing impacts have also likely contributed to low summer flows through soil compaction that reduces infiltration, loss of riparian vegetation and removal of upland ground cover (Kauffman et al. 2004).

Water Quality

Water quality is fair in the upper watershed during most of the year, as compared to ODEQ water quality standards (USDI 2000 as cited in NPCC 2005). Low summer flows on the mainstem John Day River above Dayville contribute to elevated temperatures; higher streamflows during the winter/spring and streambank erosion contribute to turbidity. Problematic eutrophication in the mainstem John Day River is a partial result of irrigation return flow and possibly cattle feedlots (NPCC 2001 from NPCC 2005). Table 8-16 lists stream segments within the Upper John Day watershed included on ODEQ's 303(d) list. Elevated stream temperatures are common to almost all the streams in the Upper John Day watershed. Historic mining has added to water quality problems by removing riparian vegetation, simplifying stream channels and changing stream substrate composition, all of which contribute to increased water temperatures.

Table 8-16. Upper John Day River watershed 303(d) listed stream segments and parameters of concern (ODEQ 2002 as cited in NPCC 2005).

Waterbody Name	Parameter	Waterbody Name	Parameter
Badger Creek	Temperature	Grub Creek	Temperature
Battle Creek	Temperature	Indian Creek	Temperature
Bear Creek	Temperature	Little Pine Creek	Temperature
Canyon Creek	Temperature	McClellan Creek	Temperature
Corral Creek	Biological Criteria	Mountain Creek	Temperature
Cottonwood Creek	Temperature	Murderers Creek	Temperature
Dads Creek	Temperature	North Fork Deer Creek	Temperature
Dans Creek	Temperature	Pine Creek	Temperature
Deardorff Creek	Temperature	Rail Creek	Temperature
Deer Creek	Temperature	Reynolds Creek	Temperature
Dog Creek	Temperature	Reynolds Creek	Temperature
East Fork Canyon Creek	Temperature	Rock Creek	Temperature
Ennis Creek	Temperature	Slyfe Creek	Temperature
Ennis Creek	Temperature	South Fork John Day River	Temperature
Fields Creek	Temperature	Strawberry Creek	Temperature
Fields Creek	Temperature	Sunflower Creek	Temperature
Flat Creek	Temperature	Tex Creek	Temperature
Flat Creek	Temperature	Tex Creek	Temperature
Grasshopper Creek	Temperature	Tinker Creek	Temperature
Grasshopper Creek	Temperature	Utley Creek	Biological Criteria
		Utley Creek	Dissolved Oxygen

Habitat Access

Strawberry Creek has numerous unscreened ditches that may strand fish. Water withdrawals dewater the lower reaches of Pine, Indian, Strawberry, Moon, Laycock, McClellan, Riley, and Field creeks and create passage problems for juvenile fish. Diversions and low flows in Strawberry Creek create passage problems for adults as well. Push-up dams and other irrigation structures throughout the Upper John Day watershed often obstruct or delay fish passage. Culverts on national forest, state, county and private lands also create passage barriers in many areas. EDT identifies obstructions as high priority restoration needs in Beech and Laycock creeks**.** Panama ditch crosses Beech Creek approximately one mile above its convergence with the John Day River, and it forms a juvenile passage barrier and possibly an adult barrier at certain flows. High water temperatures in numerous tributaries and portions of the mainstem alter or sometimes block juvenile steelhead movements in the summer months.

Riparian/Large Wood Conditions

Riparian conditions are generally degraded from historic conditions in the Upper John Day watershed. Roads along riparian corridors have altered riparian functions. The Malheur National Forest has identified 123.78 miles of roads within RHCAs in the Upper John Day watershed (MNF 2004). Timber harvest on private and public lands has altered riparian vegetation and reduced LWD recruitment potential. Grazing activities on the forest and private lands have also impacted riparian functions by reducing or eliminating native plant communities, altering soil conditions and infiltration rates (Kauffman 2004). Reduced riparian functions lead to an overall decrease in habitat diversity (pools, quality and quantity) and water quality.

Limiting Factors

Channel and riparian alterations and water withdrawals have decreased habitat complexity, dewatered channels and created passage problems in the lower reaches of many major tributaries. Habitat conditions within the upper reaches of these tributaries are generally closer to benchmark.

The major limiting factors that are common to almost all HUC5s in the upper John Day watersheds (Beech, Canyon, Laycock, and Strawberry creeks, Fields, and Upper and Upper Middle John Day) are Key habitat quantity, Habitat diversity, Flow, Sediment load, and Temperature. Channel stability is also a limiting factor on all HUC 5s in the upper John Day watershed. Key habitat quantity and Habitat diversity are the highest priority limiting factors in Fields Creek, while temperature, sediment, and predation are lower priority factors to address. Both Beech and Laycock creeks have passage obstructions that are considered high priority restoration needs.

Upper John Day MaSA

It is likely that stream channels within the Upper John Day were narrower and deeper during pre-settlement times (MNF 2004). Deep pools were numerous due to the large quantity of large woody material.

Today, tributaries to the Upper John Day have been extensively channelized for agricultural purposes. Lack of large woody debris has likely reduced channel sinuosity and stream aggradation in many forested, unconstrained reaches outside the wilderness (MNF 2004). Loss of beavers in the upper mainstem and many of its tributaries has contributed to lower streamflows and reductions in habitat diversity. Water withdrawals are extensive. For example, water withdrawals dewater the lower reaches of Pine, Indian, Laycock, Riley, Fields, McClellan, Moon, and Strawberry Creeks. Road densities are 3.07 miles/mile² on Forest Service lands in the Upper John Day HUC5.

EDT rated habitat diversity and key habitat quantity as "medium" priority restoration needs in Strawberry, and low and medium priorities respectively in Upper John Day. Channel stability is considered a low priority restoration need in Strawberry Creek.

Canyon MaSA

Hwy 395 parallels Canyon Creek for most of the creek's lower reach. Canyon Creek, as its name suggests, flows through a steep canyon with few major tributaries, except in the upper elevations. This is large and productive stream system. The lower reaches flow through a steep canyon, while the upper reaches flatten out into more productive meadow systems. The creek originates in Forest Service lands, largely within the Strawberry Mountain Wilderness. Road densities are 2.44 miles/mile² on Forest Service lands in the Canyon Creek HUC5.
EDT identifies key habitat quantity as a medium priority restoration need in Canyon Creek. Habitat diversity is identified a low priority. Streamside roads limit channel development and channel diversity.

Beech MaSA

Hwy 395 parallels Beech Creek for a majority of the stream's lower reaches. The lower reaches are largely privately owned. Beech Creek is a productive system in good water years, but many of the streams go dry in poor water years. Water withdrawals dewater the lower reaches of Fields, Laycock, Riley, McClellan, and Moon creeks. However, the streams originate on National Forest where habitat is in better condition relative to lower reaches. Beech Creek contains numerous valley bottom roads. Road densities are 2.74 miles/mile^2 on Forest Service lands in the Beech Creek HUC5.

EDT identified habitat diversity and key habitat quantity as medium priority restoration needs in the Beech Creek MaSA. Areas of Beech Creek have had extensive grazing pressure that has contributed to increased channelization, and reduced LWD, cover, and pool quality and quantity. Streamside roads also limit channel development and potential increases in habitat diversity.

Table 8-17 (NPCC 2005) provides information from EDT Diagnostic Reports on limiting factors for each HUC5 occupied by the Upper John Day steelhead population.

Table 8-17. EDT Diagnostic Report – Upper Mainstem John Day Steelhead.

Geographic area priority			Attribute class priority for restoration																
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Beech Creek	C	A	C				B		B		A				A	B		B
Canyon Creek	A	B	C				C		C						C	C		B
Fields Creek	B	A	C				C		B						B	C		A
JDR Johnson Creek	C	B							C					C	C	C		B
Laycock Creek	B	A	C				C		B		A				B	C		A
Lower JDR Clarno	C	C							C					C				B
Lower JDR Ferry Canyon	C	C							C					C				B
Lower JDR Kahler Creek	B	C							A					C		C		B
Lower JDR McDonald Ferry	B	B							C					B				
Lower JDR Muddy Creek	C								C					C				B
Lower JDR Scott Canyon	C	C							C					C				B
Lower JDR Service Creek	B	C							B					C	C	C		B
Strawberry Creek	A	A	C				C		B						B	B		B
Upper JDR	A	B					C		C						B	C		B
Upper Middle JDR		C							C					C	C	C		B

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A High; B Medium; C Low; D & E Indirect or General

Among the 15 HUC5s identified by the EDT model as important to the upper John Day River steelhead population, all of the top restoration and protection quartiles are in the upper John Day portion of the subbasin (Table 8-18).

Table 8-18. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT for Upper John Day summer steelhead.

Upper John Day Summer Steelhead								
Geographic area priority			Attribute for Restoration					
Geographic area	Protection benefit	Restoration benefit	*Flow*	*Habitat diversity*	*Obstructions*	*Sediment load*	*Temperature*	*Key habitat quantity*
Beech Creek		X	■	■	■	■	■	■
Canyon Creek	X							
Fields Creek		X		■		■		■
Laycock Creek		X		■	■	■		■
Strawberry Creek	X	X		■		■	■	■
Upper JDR	X							

Life Stages Affected

EDT modeling determined that Key habitat quantity and Habitat diversity are generally significant limiting factors in most upper John Day HUC5s. Reduced habitat complexity suggests that stream systems lack LWD, cover, quality pools, and other characteristics that are necessary to support freshwater lifestages for juvenile steelhead, as well as quality spawning habitat for adults. Elevated stream temperatures and low flows further reduce the quality and quantity of habitat for juveniles rearing in the upper mainstem and its tributaries. Elevated fine sediment loads and embedded substrates found in many streams likely reduce spawning and incubation success. Obstructions are noted as high priority restoration needs in Beech and Laycock creeks.

Viability Parameters Affected

Productivity and abundance are likely the viability parameters most affected by changes in habitat conditions in the Upper John Day population. The loss of cover, pools, LWD, and overall habitat diversity, combined with increased stream temperatures and reduced connectivity, likely has the greatest effect on fry-to-smolt survival. Lower egg-to-parr survival from sedimentation and embedded substrates also reduces freshwater productivity and abundance. Barriers in Beech and Laycock MaSAs, and other obstructions such as push-up dams, unscreened ditches and dewatered reaches have eliminated full access to the full range of historic habitat. However, the range of available habitat types should still provide for a range of life-history diversity that is similar to benchmark conditions.

Threats

Anthropogenic threats associated with these limiting factors include agricultural practices, overgrazing by livestock, removal of large trees from the riparian corridor, wetland draining and conversion, stream channelization and diking, mining, and dredging (NMFS 2004).

Agricultural practices, grazing, timber harvests, road building, and mining within the Upper Mainstem have changed the hydrology, and degraded stream and riparian conditions throughout the watershed. Wetlands have been drained and converted to pastures, streams have been diked and channelized, and extensive beaver colonies and large trees have been removed from the riparian corridor (NPPC 2005). Historic mining activity was extensive and included large-scale dredging of the upper John Day River and lode mines in the Canyon Creek watershed.

8.1.9 Umatilla River Population

The Umatilla River population of Mid-Columbia River steelhead includes nine MaSAs, eight in Oregon and one in Washington State. The population also has 12 MiSAs, which are located in both states. These MaSAs and MiSAs are listed on Table 8-19. The primary tributaries of the Umatilla River are the North and South Forks, Meacham Creek, Iskulpa Creek, Wildhorse Creek, McKay Creek, Birch Creek and Butter Creek.

Table 8-19. MaSAs and MiSAs for the Umatilla River Steelhead Population.

SPAWNING AREA NAME	TYPE	STATE
Alder	MaSA	WA
Butter	MaSA	OR
East Birch	MaSA	OR
Little Butter	MaSA	OR
McCay	MaSA	OR
Meacham	MaSA	OR
Middle Umatilla	MaSA	OR
Upper Umatilla	MaSA	OR
West Birch	MaSA	OR
Alkali	MiSA	OR
Birch	MiSA	OR
Cold Springs	MiSA	OR
Fourmile Canyon	MiSA	WA
Glade	MiSA	WA
Little McCay	MiSA	OR
Mud Spring	MiSA	OR
Sixmile (Umatilla)	MiSA	OR
Sixprong	MiSA	WA
Speare	MiSA	OR
Stewart	MiSA	OR
Wildhorse	MiSA	OR

Habitat Factors

Habitat Complexity

The mainstem Umatilla River from Wildhorse Creek to the forks and sections of 17 tributaries of the mainstem are 303(d) listed because of habitat (including substrate) problems. Habitat benchmarks developed by ODFW were used to 303(d) list stream reaches based upon standardized habitat surveys (Moore et al. 1999 as cited in NPCC 2004c). Parameters measured in these surveys include habitat features known to be important to salmonids such as presence and amount of large woody debris, pool frequency, presence of eroding streambanks, type of riparian vegetation, stream channel form and pattern, and the proportion of the substrate composed of fine materials. Key habitat quantity and habitat diversity are also identified as medium impact limiting factors that are pervasive throughout the subbasin. Channel stability is frequently noted as a low impact limiting factor.

Overall, instream habitat has been simplified and pool habitat has decreased. Some stream reaches have been channelized in agricultural fields to prevent flooding of fields and natural channel movement into fields. Channelization greatly decreases winter habitat (e.g., braided channels, sloughs) for juvenile salmon and steelhead. This habitat is very important for overwinter survival and growth of juvenile. The loss of this type of habitat in the Umatilla River and its tributaries is thought to be one of the most significant causes of the reduction in naturally surviving salmonid and steelhead (personal communication: C. Contor, CTUIR, April 2004; as cited in NPCC 2004c). Other primary causes of low habitat diversity/complexity include past timer harvest practices that removed conifers from riparian zones, and the ongoing removal of LWD from streams to prevent flooding and streambank erosion.

Sediment/Substrate

The Umatilla River produces large amounts of sediment, much of which originates from weathered basalt and unconsolidated loess deposits -- the dominant geology in the subbasin. The primary sources include both bank and upland erosion of tributaries and tributary watersheds, both of which may be accelerated by land uses (ODEQ et al. 2001). The dominant erosion processes in the subbasin are surface erosion by sheetwash, rills and gullies, and bank erosion (ODEQ et al. 2001). Peak sedimentation usually occurs during rainstorms or snowmelts associated with freeze and thaw periods (CTUIR and ODFW 1990).

The entire Umatilla mainstem from the mouth to the forks is 303(d) listed for either sediment or turbidity. The 303(d) listings were based on stream surveys, using ODFW Habitat Benchmarks for silt, sand, and organics, in upper watershed areas. The TMDL uses turbidity as the target for reducing the amount of suspended material available for settling.

One of the sediment-impaired stream segments that significantly deviated from the target standard for turbidity was Wildhorse Creek (at its confluence with the Umatilla River), which had a peak turbidity value of over 5,000 NTU measured on April 23, 1997. High levels were also measured in McKay Creek. Wildhorse Creek turbidity mainly results from spring runoff, while McKay's turbidity is mostly a result of bottom withdrawal of water from the reservoir for flow augmentation. Composite samples of turbidity, collected at various stations during the winter of 1997-1998, show that Tutuilla, Birch, and five sites on the Umatilla mainstem exceeded standards on numerous occasions (ODEQ et al. 2001).

Surveys conducted by ODFW and CTUIR throughout the Umatilla River subbasin found that 19 of 42 stream reaches had fine sediment as the dominant substrate (Boyd et al. 1999 as cited in NPCC 2004c). In the Patawa/Tutuilla watershed, fine sediment made up the dominant substrate in 9 of 19 reaches surveyed (Watershed Professionals and Duck Creek Associates 2003 as cited in NPCC 2004c). Substrate sediment is less of a problem in the upper Umatilla subbasin; a survey of the upper Umatilla River and Meacham Creek by the Umatilla National Forest (2001) in which substrate embeddedness was measured directly found that only two sub-watersheds of 18 had embeddedness levels greater than 35% (a level of embeddedness considered detrimental to salmon) (NPCC 2004c).

EDT analyses show that sediment is a large impact limiting factor in many areas of the Umatilla, especially in Butter and Wildhorse creeks, in the lower reaches of the Umatilla, and in reaches of Umatilla mainstem from Mission Bridge to Meacham Creek.

Changes in Peak/Base Flows

The patterns in flow observed in the Umatilla/Willow subbasin are the result of snow melt and rain in late winter and early spring which cause peaks in flow. Water runoff peaks in April, while the lowest flows, or baseflows, generally occur in September. The average monthly discharge of the Umatilla River near its mouth (measured at RM 2.1) varies from 23 cubic feet per second (cfs) in July to 1095 cfs in April (low flow at the mouth occurs in July rather than September because of upstream removals for irrigation). This difference in monthly discharge largely reflects seasonal variation in precipitation and snow melt. Summer baseflows can be extremely low and many of the larger tributaries lose all surface flow during the summer through parts of their lengths. Flows in sections of Birch, McKay, Butter, Meacham, Wildhorse and Iskuulpa creeks are subsurface during low flow periods (ODEQ 1998, as cited in NPCC 2004c).

Past evaluations of the Umatilla River have identified summer low flows as a primary limiting factor to salmonid natural production throughout all life stages (Boyce 1985, Contor et al. 1995, and CTUIR 1994; as cited in White et al. 2004). EDT identifies flow as either a medium or low impact limiting factor in almost all reaches of the Umatilla Subbasin.

Fluctuation of flows related to Umatilla Basin Project operations, for both the winter-spring storage and spring-fall release periods, is identified as a possible concern for juvenile steelhead and the food web on which they depend (BOR 2001). Significant fluctuations in the flows on a weekly, daily, or even hourly basis may cause cyclic dewatering and rewatering of near shore habitats, riffles, and pools, which reduces biotic productivity and strands salmonid fry (BOR 2001), particularly in McKay Creek. Currently, there are six major irrigation diversions in the lower Umatilla River that withdraw approximately 129,000 acre-feet on an average year (Umatilla River Subbasin Local Agricultural Water Quality Advisory Committee et al. 1999, as cited in NPCC 2004c). The irrigation withdrawals dewater the river below Dillon Dam, resulting in an average daily flow over a 14-day period of less than 1 cfs.

During late spring through late fall (April to November), water is released from McKay Reservoir to supply water for irrigation and instream uses. Summer discharge has more than tripled from RM 52.0 to 27.2 since the early 1900's; however, the river has been virtually de-watered from RM 27.2 to the confluence with the Columbia River (White et al. 2004). Streamflows below McKay Dam fluctuate greatly depending on flood water releases, irrigation releases, and other operations from McKay Reservoir (BOR 2001). BOR computer modeling analyses indicated that these water releases would increase Umatilla River flows. The model predicted that water releases in the late spring would aid juvenile steelhead in their outmigration, and that water releases in the summer and fall would aid juvenile summer rearing and adult upstream migration. The model also predicted that increased flows would connect pool and riffle habitat, increase the width and depth of flow, and improve velocity, water temperature, rearing space, and food production. Despite these predictions, however, actual July and August streamflows in the lower Umatilla River fall well below the recommended levels, with or without the operation of the Umatilla Basin Project, and often dewater the lower three miles of the Umatilla River completely from July 1 to August 15. These conditions delay steelhead entry into the Umatilla Subbasin (BOR 2001, ODEQ *et al.* 2001).

The conversion of native vegetation to cropland has also changed the hydrology of the Umatilla Subbasin, beyond those effects associated with irrigation and channelization. For example, the conversion of large tracts of land into winter wheat/summer fallow crop systems results in slower infiltration into the ground and greater runoff of water into streams during precipitation events (NPCC 2004c).

Water Quality

Summer water temperatures in the lower Umatilla River frequently exceed the incipient lethal limit for salmonids of 21°C (ODEQ et al. 2001; White et al. 2004). Water temperature is a concern throughout most of the Umatilla/Willow subbasin during periods of low flow (May until early November). On the 1998 303(d) list, 287 miles of the Umatilla River and its tributaries were listed as impaired for elevated water temperatures including the entire mainstem Umatilla River (ODEQ et al. 2001 as cited in NPCC 2004c)(see Table 8-20). The highest water temperatures have been recorded in late July and early August when ambient air temperatures are high. During this period, the Umatilla River warms rapidly from the headwaters to the mouth, reaching sub-lethal (64-74°F, 20-23°C) and incipient lethal temperatures (70-77°F, 21-25°C) for its entire length (Boyd et al. 1999; Contor and Crump 2003 as cited in NPCC 2004c). White et al. (2004) noted that during the 2002 water year, mean weekly water temperature at RM 2.1 on the Umatilla River ranged from 39.2°F to 88.5°F. Daily mean water temperatures exceeded 75.2°F for 55 days in 2002, with 31 of those days at or above 82.0°F (White et al. 2004). Many of its tributaries also reach sub-lethal and incipient lethal ranges for salmonids (Boyd et al. 1999; CTUIR 2004 as cited in NPCC 2004c).

Excessive stream temperatures in the Umatilla/Willow subbasin are influenced primarily by non-point sources including riparian vegetation disturbance (reduced stream surface shade), summertime diminution of flow from irrigation withdrawals and other sources (reduced assimilative capacities), and channel widening (increased surface area exposed to solar radiation) (ODEQ et al. 2001 as cited in NPCC 2004c). There is also a lack of natural channel sinuosity and form that would allow significant interaction between surface flows and hyporheic flows.

Releases of water from McKay Reservoir during summer generally positively impact temperatures of reaches of the Umatilla River below the McKay Creek confluence (RM 50.5). Surveys determined that hypolimnetic releases of cool water from the reservoir during early summer months kept temperatures suitable for salmonids in areas between the McKay Creek confluence and Westland Dam (RM 27.2) (Contor et al. 1997 as cited in NPCC 2004c). However, releases from McKay Reservoir for fish are not made from July 1 to approximately September 15, though water is released to provide for irrigation. In addition, warmer epilimnetic waters can be discharged upon the depletion of the hypolimnion and can contribute to unsuitable habitat conditions for salmonids (Contor et al. 1997 as cited in NPCC 2004c).

The Umatilla Subbasin's coolest mid-summer recorded temperatures are in the North Fork of the Umatilla River, where maximum summer temperatures usually do not exceed the state standard of 64°F (17.8°C). For example, in the summer of 2002, maximum water temperature in the North Fork did not exceed 60.8°F (16.0°C) (Contor and Crump 2003 as cited in NPCC 2004c). The South Fork of the Umatilla River experiences higher summertime temperatures often above 64°F, though rarely above 70°F. Data indicate a significant increase (approximately 5° F) in temperature from the Umatilla River east of the Gibbon site (RM 80.0) to the Umatilla River at Cayuse Bridge (RM 69.4). This increase in temperature is attributed to Meacham Creek which enters the Umatilla Mainstem at RM 79. Summer water temperatures in Meacham Creek are frequently in the high 60s ºF. However, maximum summer temperatures drop further downstream (at RM 50) as a result of cold water releases from McKay Reservoir.

One of the warmest tributaries of the Umatilla River is Wildhorse Creek. This drainage regularly experiences excessive summertime stream temperatures throughout the entire stream length. Headwaters often exceed 70˚F for long periods in the summer, while lower Wildhorse Creek can often experience stream temperatures exceeding 85˚F.

The lower Umatilla River and the North Hermiston Drain are in violation of EPA ammonia standards, primarily because of excessive temperatures and pH during the summer months (ODEQ et al. 2001). Other problem areas include Butter Creek, where ammonia concentrations have been measured at 0.3 to greater than 0.4mg/L (ODEQ 1998).

Excessive growth of attached algae (periphyton) and attendant increases in pH are common during summer months throughout much of the mainstem Umatilla River (from Speare Canyon, RM 44, to the forks) (ODEQ et al. 2001). Large periphyton mats can be found in this section of the Umatilla River in the summer, affecting river odor, aesthetics, contact recreation, and pH. As periphyton obtains carbon dioxide for cell growth it decreases bicarbonate levels in the water. This has the effect of increasing pH levels, which can be stressful to fish. Because periphyton growth is positively influenced by water temperature, patterns in summer water pH are influenced by water temperature. pH increases from the forks to RM 58, where it frequently exceeds 9.0 (the water quality standard); pH drops at RM 49 because of inputs of cold water from McKay Reservoir and then increases downstream where it routinely exceeds the water quality standard at Yoakum Bridge (RM 37.2)(ODEQ et al. 2001 as cited in NPCC 2004c). Elevated summertime temperatures and excessive algal growth are also likely contributors to high pH levels recorded in Willow Creek, from the mouth upstream to Heppner

Table 8-20. Impaired stream reaches from the 1998 303(d) list and used for development of the 2001 Umatilla Subbasin TMDL (ODEQ et al. 2001).

Parameter	Stream	Segment (boundaries)	Criterion
Temperature	Birch Creek	Mouth to headwaters	Rearing 64°F
	Buckaroo Creek	Mouth to headwaters	
	E. Birch Creek	Mouth to Pearson Creek	
	EF Meacham Creek	Mouth to headwaters	
	McKay Creek	Mouth to McKay Reservoir	
	Meacham Creek	Mouth to headwaters	
	NF McKay Creek	Mouth to headwaters	
	NF Meacham Creek	Mouth to headwaters	Oregon Bull Trout
	NF Umatilla River	Mouth to headwaters	
	Shimmiehorn Creek	Mouth to headwaters	
	SF Umatilla River	Mouth to headwaters	
	Squaw Creek	Mouth to headwaters	Rearing 64°F
	Umatilla R.	Mouth to Lick Creek	
	W. Birch Creek	Mouth to headwaters	
	Westgate Canyon	Mouth to headwaters	
	Wildhorse Creek	Mouth to headwaters	
Sediment	Beaver Creek	Mouth to headwaters	See Narrative
	Birch Creek, WF	Mouth to headwaters	
	Boston Canyon Creek	Mouth to headwaters	
	Coonskin Creek	Mouth to headwaters	
	Cottonwood Creek	Mouth to headwaters	
	Line Creek	Mouth to headwaters	
	Little Beaver Creek	Mouth to headwaters	
	Lost Pin Creek	Mouth to headwaters	
	McKay Creek, NF	Mouth to headwaters	
	Meacham Creek	East Meacham Creek to	
	Mill Creek	Mouth to headwaters	
	Mission Creek	Mouth to headwaters	
	Moonshine Creek	Mouth to headwaters	
	Rail Creek	Mouth to headwaters	
	Sheep Creek	Mouth to headwaters	
	Twomile Creek	Mouth to headwaters	
	Umatilla River	Wildhorse Creek to Forks	
Turbidity	Umatilla River	Mouth to Mission Creek	>30 NTU
pH	Umatilla River	Speare Canyon to Forks	pH 6.5-9.0
Nitrate	Wildhorse Creek	Mouth to headwaters	>10mg/L
	Spring Hollow Creek	Mouth to headwaters	
Ammonia	Umatilla River	Mouth to RM 5	pH dependent
	North Hermiston Drain	Mouth to headwaters	
Bacteria	McKay Creek	Mouth to McKay Reservoir	Water Contact Recreation (fecal coliform 96-Std)
	Umatilla River -- Summer	Mouth to Speare Canyon	
Aquatic Weeds/Algae	Umatilla River	Speare Canyon to Forks	Growth considered to be deleterious to aquatic life, public health, recreation or industry

Table 8-20 (continued). Impaired stream reaches from the 1998 303(d) list and used for development of the 2001 Umatilla Subbasin TMDL (ODEQ et al. 2001).

Parameter	Stream	Segment (boundaries)	Criterion
Flow Modification	Birch Creek	Mouth to Headwaters	
	Umatilla River	Mouth to Speare Canyon	
Habitat Modification	Bell Cow Creek	Mouth to Headwaters	ODFW Habitat Benchmarks
	Boston Canyon Creek	Mouth to Headwaters	
	Calamity Creek	Mouth to Headwaters	
	Coonskin Creek	Mouth to Headwaters	
	Cottonwood Creek	Mouth to Headwaters	
	Darr Creek	Mouth to Headwaters	
	E. Birch Creek	Mouth to Headwaters	
	Line Creek	Mouth to Headwaters	
	Little Beaver Creek	Mouth to Headwaters	
	Lost Pin Creek	Mouth to Headwaters	
	Meacham Creek	Mouth to Headwaters	
	Mill Creek	Mouth to Headwaters	
	Mission Creek	Mouth to Headwaters	
	Moonshine Creek	Mouth to Headwaters	
	N.F. McKay Creek	Mouth to Headwaters	
	N.F. Meacham Creek	Mouth to Headwaters	
	Rail Creek	Mouth to Headwaters	
	Umatilla River	Wildhorse Creek to Forks	
	Wood Hollow Creek	Mouth to Headwaters	

Habitat Access

In the Umatilla River subbasin, 36 barriers were identified in the Umatilla Subbasin Plan and these are listed in Table 8-21, along with their priority for removal. Though it is not mentioned in the list McKay Dam was not designed to include fish passage facilities, and blocks steelhead and salmon access to approximately 108 miles of highly productive tributary habitat in upper McKay Creek (CTUIR 2001). Historic abundance of steelhead in McKay Creek is unknown, but CTUIR tribal members report that a high number of steelhead spawned in McKay Creek before the construction of McKay Dam and Reservoir in 1927 (CTUIR 2001).

A number of significant passage barriers remain, particularly in Birch, and Butter creeks. Unscreened water diversions can also have a substantial impact on anadromous fish. Although all known gravity feed diversions in the anadromous portion of the Umatilla subbasin are screened, it is not known to what extent pump diversions have been screened in the anadromous portion of the subbasin.

Table 8-21. **Barriers to upstream passage on streams in the Umatilla River Subbasin**.

Stream	River Mile	Barrier Type	Step Height Est. (m)	Degree	Recommended Action	Priority
Umatilla R.	1.5	Channel Mod.	0.7	Partial	Modify	L
Umatilla R.	2.4	Irrigation Dam	1.0	Partial	Modify	M
Umatilla R.	49	Irrigation Dam	1.2	Partial	Remove	M
Butter Creek	7.9	Flash Boards	2.3	Complete	Modify	L
Butter Creek	27.2	Irrigation Dam	1.4	Complete	Modify	L
Butter Creek	43.0	Irrigation Dam	1.2	Complete	Modify	L
Johnson Cr. (Butter Trib)	0.3	Culvert	0.8	Partial	Modify	M
Birch Creek	0.5	Pipe Casing	1.4	Partial	Modify	M
Birch Creek	2.5	Irrigation Dam	1.5	Partial	Modify/Remove	H
Birch Creek	5.0	Irrigation Dam	1.2	Partial	Modify/Remove	H
Birch Creek	10.0	Irrigation Dam	1.0	Partial	Remove	M
Birch Creek	11.0	Irrigation Dam	0.7	Partial	Remove	L
Birch Creek	12.0	Irrigation Dam	1.0	Partial	Modify	M
Birch Creek	15.0	Irrigation Dam	1.7	Partial	Remove	H
West Birch Cr.	1.0	Irrigation Dam	?	Partial	Modify	M
West Birch Cr.	3.5	Irrigation Dam	2.1	Partial	Modify	H
West Birch Cr.	3.8	Bridge	1.2	Partial	Modify	H
West Birch Cr.	5.5	Irrigation Dam	1.4	Partial	Remove	H
West Birch Cr.	8.5	Irrigation Dam	1.5	Partial	Remove	H
Bridge Cr. (West Birch)	2.0	Culvert	?	Complete	Modify	H
East Birch Cr.	4.0	Irrigation Dam	0.7	Partial	Remove	L
East Birch Cr.	9.0	Irrigation Dam	1.0	Partial	Remove	L
Jungle/Windy Spr. (Pearson)	0.1	Culvert	0.15	Partial	Modify	L
Wildhorse Cr.	0.1	Irrigation Dam	0.7	Partial	Modify	L
Wildhorse Cr.	18.8	Bridge	1.0	Partial	Modify	L
Greasewood Cr.	0.4	Irrigation Dam	0.6	Partial	Modify	L
Mission Cr.	0.9	Bedrock Drop	0.5	Partial	Modify	M
Mission Cr.	3.3	Bridge/Culvert	0.7	Partial	Modify	M
Coonskin Cr.	0.3	Bridge	0.5	Partial	Modify	M
Coonskin Cr.	0.9	Pipe Casing	1.1	Partial	Modify	M
Whitman Spr.	0.1	Culvert	0.5	Complete	Modify	L
Red Elk Can.	0.2	Culvert	0.8	Partial	Modify	L
Minthorn Spr.	0.1	Culvert	0.5	Partial	Modify	L
Unnamed Trib to SF Umatilla at RM 1.5	0.1	Culvert	0.5	Complete	Modify	M
Camp Creek	0.25	Irrigation Dam	1.3	Partial	Remove	M
Unnamed trib to Umatilla R. at RM 81.2	0.1	Culvert	0.6	Partial	Modify	L
Two mile Creek	1.25	Culvert	?	?	Modify	L

Riparian/Large Wood Conditions

Riparian vegetation on the mainstem Umatilla River and many tributaries is in poor condition, with approximately 70% of 422 miles inventoried identified as needing riparian improvements (CTUIR and ODFW 1990 as cited in NPCC 2004c). Losses of riparian vegetation are particularly high in the lower subbasin; Kagan et al. (2000 as cited in NPCC 2004c) estimated these losses at greater than 95% as compared to pre-settlement conditions (c. 1850).

Limiting Factors

Elevated water temperatures, low summer flows, and excessive fine sediment are significant limiting factors in the Umatilla Subbasin. McKay Dam blocks steelhead and salmon access to approximately 108 miles of productive tributary habitat in upper McKay Creek. Channel and riparian alterations and water withdrawals have decreased habitat complexity, dewatered channels, created passage problems, and contributed to significant water quality problems. Habitat conditions within the upper reaches of the Umatilla and its tributaries are generally closer to benchmark conditions.

The top limiting factors, as identified by EDT, for this population are: 1) Temperature, 2) Sediment, 3) Obstructions and 4) Key habitat quantity.

EDT analysis for the Umatilla ranked various limiting factors as having high (or large), medium, low, or no impact on steelhead and other anadromous salmonid's survival. To determine which factors are most pervasive in the subbasin in limiting the survival of anadromous focal species, the percentage of geographic areas (GAs) in which a factor is limiting was determined for each species. Figure 8-2 shows the limiting factors that had a high impact on survival on steelhead and the proportion of geographic areas (out of the total number that species is found in) in which they occurred.

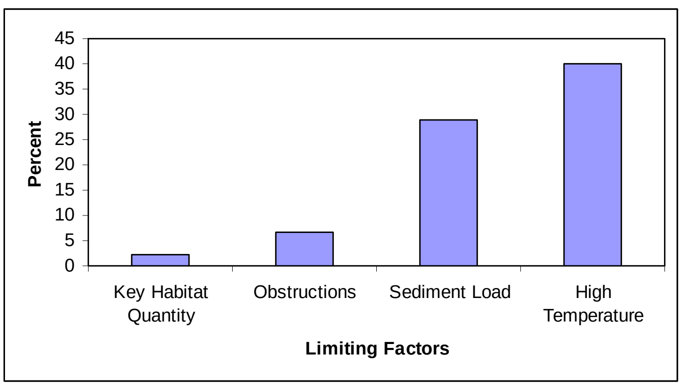


Figure 8-2. The percentage of all geographic areas in which the graphed limiting factors have a large impact on the survival of steelhead. Steelhead are found in a total of 44 GAs.

Figure 8-3 below, depicting limiting factors with a medium impact on steelhead survival, reveals that both habitat diversity and habitat quantity are important limiting factors that are pervasive throughout the subbasin.

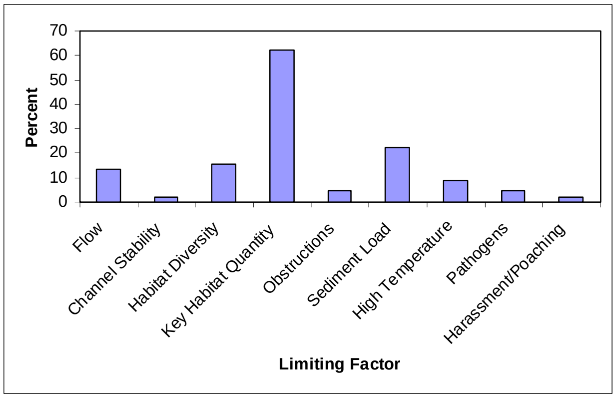


Figure 8-3. The percentage of all geographic areas in which the graphed limiting factors have a medium impact on the survival of steelhead. Steelhead are found in a total of 44 GAs.

Figure 8-4 below illustrates the EDT stream reaches as identified by the Umatilla Subbasin planners. The reach numbers are also listed in Table 8-22.

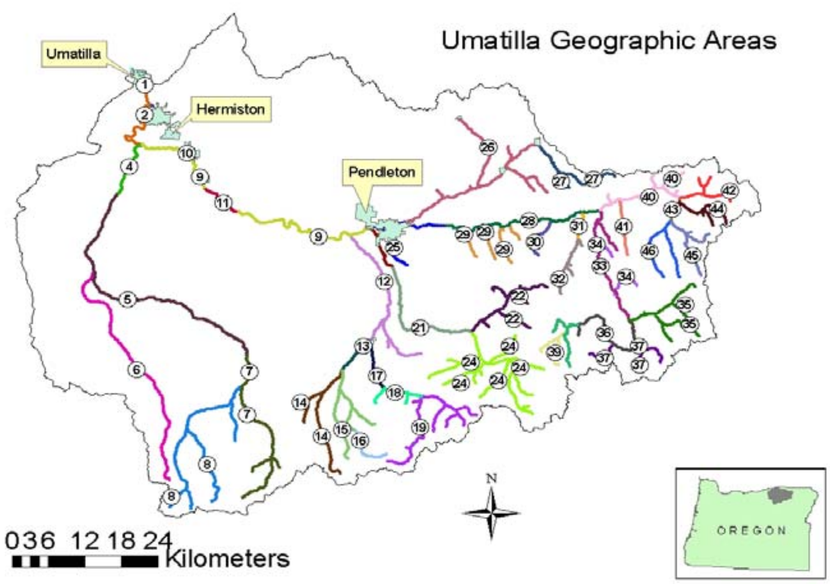


Figure 8-4. Geographic areas used in the EDT analysis for the Umatilla River Subbasin.

Areas include:

GA1-2:	Lower Umatilla
GA4-8:	Butter Creek and tributaries
GA9-11:	Mainstem Umatilla from Butter Creek to McKay Creek
GA12-19:	Birch Creek and its tributaries
GA20-24:	McKay Creek and its tributaries
GA25:	Umatilla mainstem from McKay Creek to Mission Bridge
GA26-27:	Wildhorse Creek and its tributaries
GA28-32:	Umatilla mainstem from Mission Bridge to Meacham Creek and its tributaries
GA33-37:	Meacham Creek and its tributaries
GA40-41:	Umatilla from Meacham Creek to the forks and its tributaries
GA42:	North Fork Umatilla
GA43-46:	South Fork Umatilla and various tributaries)

Table 8-22. EDT restoration and protection priorities for Umatilla summer steelhead.

Umatilla Summer Steelhead
Protection and Restoration Strategic Priority Summary

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
GA1			•		•		•		•					•	⬤	●		•
GA11			•		•		•		•					•	•	•		
GA12		○	•				•		•		●		•		●	⬤		●
GA13		○	●				●		●	•	●		•		●	⬤		●
GA14	○		•				•		•						●	●		●
GA15	◦	○	•				•		•		●				●	●		●
GA16	◦		•				•		•							•		●
GA17		◦	•				•		•	•					●	⬤		●
GA18	◦	◦	•				•		•						●	•		●
GA19	○	◦					•		•							•		●
GA2	◦	◦	•		•		•		•					•	⬤	•		
GA20		◦	•				•		•	●				•	●	•		⬤
GA21		○	•				•		●		⬤		●	•	●	⬤		●
GA22			•				•		•				•			⬤		●
GA24			•				•		•							●		●
GA25			•		•		•		•					•	⬤	•		
GA26							•		•						⬤	•		
GA27		◦	•				●		•						⬤	⬤		•
GA28		○	•		•		•		•				●	•	●	⬤		•
GA29		◦					•		•				•		⬤	⬤		●
GA3			•				●		●						⬤			●
GA30			•				•	•	•							⬤		●
GA31			•				•	•							●	⬤		●
GA32		○	•				•	•	•						●	⬤		●
GA33	○	○	•		•		•	•	•					•		⬤		●
GA34			•		•		•		•					•	•			•
GA35	○	○			•		•		•		⬤			•		•		•
GA36	◦	○	•		•		•		•					•		⬤		●
GA37	○				•		•		•					•				●
GA38			•		•		•		●					•	⬤			●
GA39					•		•				•			•	⬤			●
GA4		◦	•				●		●	•					⬤	⬤		●
GA40	○	○	•				•		•							⬤		•
GA41			•				•	•	•									●
GA42	○	◦	•															
GA43	○	◦	•				•	•	•									
GA44	○						•	•										
GA45	○	◦	•				•	•	•									●
GA46	○						•		•									
GA5		○	•				●		●	•	⬤		•		⬤	⬤		●
GA6		◦	•				●		●	•					⬤			●
GA7			•				•		•				•		⬤	⬤		●
GA8			•				•		•				•		⬤	⬤		●
GA9	○	◦	•		•		•		•					•	●			

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A		B		C		D & E	
○ ⬤	High	○ ●	Medium	◦ •	Low		Indirect or General

Table 8-23 provides the results of an EDT analysis that identified and prioritized reaches for restoration in the Umatilla Subbasin.

Table 8-23. Priority restoration reaches for summer steelhead (NPCC 2004c).

Steelhead Priority Geographic Areas for Restoration

GA	GA Description	Priority	Rationale for Removal
GA12	Birch, mouth to forks including Stewart Creek	1	
GA5	Butter Creek, Madison Diversion to East Butter	2	Steelhead currently blocked by barriers and flow
GA28	Umatilla, Mission Bridge to Meacham Creek	3	
GA40	Umatilla, Meacham to Forks including all tribs except Ryan Creek	4	
GA33	Meacham, Mouth to North Fork	5	
GA15	West Birch, Bear top of gorge, including tribs	6	
GA21	Mckay Cr, McKay Dam to North Fork	7	Steelhead blocked by barrier
GA13	West Birch, mouth to Bear Creek	8	
GA32	Squaw Cr, Bachelor Canyon to headwaters, inlcuding tribs	9	
GA35	NF Meacham and tribs	10	
GA27	Wildhorse Cr, Athena to Headwaters, inlcuding tribs	11	Very limitied presence/use
GA19	Pearson Creek (East Birch)	12	
GA20	Mckay Cr, mouth to McKay Dam	13	Adults blocked by barrier
GA17	East Birch mouth to California Gulch	14	
GA42	NF Umatilla, mouth ot headwaters including tribs	15	Wilderness Area
GA6	Little Butter	16	Steelhead currently blocked by barriers and flow
GA18	East Birch, Cal Gulch to headwaters and tribs except Pearson	17	
GA2	Umatilla, Threemile Dam to Butter Creek	18	
GA14	Bear Creek and tribs (West Birch)	19	
GA34	Meacham, Tribs from mouth to NF	20	
GA8	Butter Cr, EF to headwaters and Johnson Creek	21	Steelhead currently blocked by barriers and flow
GA44	Buck Creek and tribs	22	Wilderness Area
GA1	Umatilla, mouth to Threemile Dam	23	Low restoration opportunity for sediment and temperatu
GA 30	Buckaroo Creek	24	
GA7	EF Butter and tribs	25	
GA38	Meacham, Twomile to headwaters, including Twomile	26	

Life Stages Affected

EDT modeling determined that temperature, sediment, and key habitat quantity are generally important limiting factors in most areas of the Umatilla Subbasin. The watershed generally lacks LWD, cover, quality pools, and other characteristics that are necessary to support freshwater life stages for juvenile steelhead, as well as quality spawning habitat for adults. Elevated stream temperatures and low flows, found in the Umatilla and its tributaries, further reduce the quality and quantity of habitat for juveniles rearing in the Subbasin. Elevated fine sediment loads and embedded substrates found in the Umatilla and many of its tributaries likely reduce spawning and incubation success. Obstructions in various parts of the Subbasin reduce the success of all steelhead life stages.

Viability Parameters Affected

Productivity and abundance are likely the viability parameters most affected by changes in habitat conditions in the Umatilla population. The lack of summer flow, cover, pools, LWD, and overall habitat diversity, combined with elevated stream temperatures and reduced connectivity, likely has the greatest effect on fry-to-smolt survival. In numerous reaches, elevated fine sediment levels likely reduce egg-to-parr and consequently, freshwater productivity and abundance. Obstructions, such as major irrigation dams, unscreened ditches, and dewatered reaches have eliminated access to the full range of historic habitat. However, the range of available habitat types should still provide for a range of life-history diversity somewhat reduced from historic.

Threats

Cultivation, grazing, forestry, urban development, and water storage and diversion for irrigation and flood control have degraded aquatic habitats throughout the Umatilla Subbasin (NOAA 2004c). Large-scale water developments by the BOR significantly reduce the quality and quantity of habitat available for juvenile steelhead. Summer withdrawals annually reduce the river to a series of disconnected pools (BOR 2001 as cited in NOAA 2004c). Stream temperatures frequently exceed lethal limits for salmonids due to water withdrawals and reduced flows, reduced riparian shading, channel modifications and increased width/depth ratios, and irrigation return flows. Many point and non-point pollution sources also contribute to poor water quality within the basin. High sediment levels and turbidity from streambank erosion and poor agricultural practices on highly erodible soils also degrades water quality (NPCC 2004c).

In addition, the Union Pacific Railroad runs adjacent to the Umatilla River mainstem from near its mouth to Meacham Creek (RM 79) and the entire length of Meacham Creek. Asphalt roads run adjacent to the Umatilla for much of its length from the mouth to RM 89. Roads and/or railroads are also found along the great majority of most major tributaries. Abandoned railroads also impact streams in the subbasin. For example, Union Pacific and Northern Pacific had railroads running out of Pendleton to Adams/Athena and Helix /East Juniper Canyon respectively until 1978. The legacy of those road-beds is still a major influence on Wildhorse Creek and its tributaries (personal communication: J. Williams, USDA-ARS, January 2004 as cited in NPCC 2004c).

8.1.10 Walla Walla River Population

The Walla Walla Basin comprises approximately 4,553 sq km (1,758 sq miles) of land, spanning all or part of five counties along the Oregon-Washington boundary east of the Columbia River. The main tributaries of the Walla Walla River are the North and South forks, Couse Creek, Pine Creek, Birch Creek, Cottonwood Creek and Mill Creek. The North and South forks and Couse Creek are entirely within Oregon, but the remaining tributaries span the state line. Birch and Pine creeks originate in Oregon, but their confluence with the Walla Walla River is in Oregon. Cottonwood Creek flows into Yellowhawk Creek in Washington. Mill Creek originates in Washington, flows through Oregon for approximately six miles and enters the Walla Walla River in Washington, just west of the City of Walla Walla. The Walla Walla population is comprised of five MaSAa and six MiSAs (Table 8-24).

Table 8-24. Walla Walla River major and minor spawning areas.

SPAWNING AREA NAME	TYPE	STATE
Mill	MaSA	WA, OR
Pine	MaSA	WA, OR
Dry	MaSA	WA
Cottonwood	MaSA	WA, OR
Walla Walla	MaSA	OR
Woodward Canyon	MiSA	WA
Switzler	MiSA	WA
Vansycle Canyon	MiSA	WA, OR
Juniper	MiSA	OR
Spring Valley	MiSA	WA
Below Spring Valley	MiSA	WA

Habitat Factors

Habitat Complexity

Habitat complexity is generally reduced or absent in the lower reaches of the Walla Walla River, particularly in channelized areas. Habitat complexity in headwater areas of some streams, including the South Fork, North Fork, and Mill Creek is close to or at properly functioning condition. The lower reaches of these tributaries, particularly in areas of agricultural or urban development, have poor habitat complexity due to a lack of pools and LWD.

Sediment/Substrate

EDT analyses for streams occupied by this population indicate that elevated fine sediment levels in stream substrates are present, particularly in the lower reaches. Land management activities such as agriculture and road building add fine sediment to streams and reduced high flows can interrupt normal sediment flushing events.

Changes in Peak/Base Flows

In general, the runoff pattern in the Walla Walla River Basin consists of high flows from November through May and low flows from June through October. The spring snowmelt flood period usually extends from about the first of March through the end of May, but peak discharges resulting from snowmelt runoff rarely result in damaging stages. In the past, winter flood peaks in the period of December through February have been responsible for flash-flood damage, caused by intense rainfall occurring on ground with a high soil moisture content or by warm temperatures and rainfall on snow and frozen ground. (USCOE 1997).

The Walla Walla River valley is extensively and intensively irrigated (NPCC 2004d). Primary water sources include the Touchet and Walla Walla rivers, East-West Canal, Gardena Canal, Lowden Canals, gravel aquifers, and the underlying basalt aquifer system (NPCC 2001 and NPCC 2004d). Water diversions reduce flows in some reaches of the river and principle tributaries; the lower Touchet River, lower Mill Creek, and Walla Walla River near the border of Oregon and Washington have been completely dewatered in the past (NPCC 2004d) (Table 8-25, NPCC 2001 and 2004d). An increasing number of shallow individual domestic wells resulting from urban sprawl also pose a very real and significant deterrent to full utilization of the available water resources in the underlying aquifer (NPCC 2001 and NPCC 2004d).

Table 8-25. Average monthly flows for principle tributaries and portions of the Mainstem Walla Walla River (NPCC 2001 and 2004d).

Tributary/ Stream Segment	USGS Gage #	General Location	Period of Record	Average Monthly Flows (cfs)											
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mill Creek	14013000	Near Walla Walla WA	1913-1998	131	155	159	174	140	75	38	31	31	37	73	113
Dry Creek	14016000	Near Walla Walla WA	1949-1966	37	53	48	46	24	10	2	1	2	4	12	31
Walla Walla River	14018500	Near Touchet WA	1951-1998	1112	1303	1201	1071	725	252	42	19	40	80	300	812
South Fork Walla Walla River	14010000	Near Milton-Freewater OR	1907-1990	175	188	214	280	305	205	124	109	107	111	135	166
North Fork Walla Walla River	14011000	Near Milton-Freewater OR	1930-1968	56	66	82	119	96	41	8	4	5	11	27	52

Water Quality

Water quality in the Walla Walla subbasin is affected by anthropogenic activities. Higher water quality in the upper drainage generally degrades in lower elevations (NPCC 2001 and NPCC 2004c). Rain on frozen snow events in winter and spring often lead to high surface erosion in agricultural lands (NPCC 2001 and NPCC 2004c). Temperature is a primary concern, with much of the lower Walla Walla remaining above 20°C (68°F) for most of the summer (NPCC 2001 and NPCC 2004d). In Oregon, the Walla Walla River, North and South Forks of the Walla Walla River, and Mill Creek were all listed as 303(d) water quality limited for temperature in 2002 (ODEQ 2002).

Habitat Access

There are several total or partial fish passage barriers in the streams occupied by this population. Obstructions are caused by low stream flow and channel spawning diversion structures and dams. Some culverts also act as fish passage barriers.

Riparian/Large Wood Conditions

Vegetative conditions in the Walla Walla subbasin reflect land use practices. Historically, extensive riparian zones existed along streams in the Walla Walla subbasin (USCOE 1997). Along the Oregon portion of the river, 70% of the existing riparian zone is in poor condition (Water Resources Commission 1988, cited in USCOE 1997). Where steppe grassland vegetation communities once existed in the valley, crops and invasive plant species have largely replaced them.

Limiting Factors

Channel and riparian alterations and water withdrawals have decreased habitat complexity, dewatered channels, and created fish passage problems in the lower reaches of the Walla Walla River and its major tributaries. Dams and channel spanning structures interrupt natural sediment transport. Habitat conditions within the upper reaches of tributaries and the North and South Fork are generally at or closer to properly functioning condition.

The top limiting factors, as identified by EDT, for this population are: (1) Sediment load, (2) habitat diversity, (3) flow, (4) temperature, and (5) fish passage obstructions.

Mill Creek MaSA

EDT analysis for Mill Creek indicated that fish passage, sedimentation, temperature, habitat diversity and key habitat quantity were primary limiting factors. Channel stability and food were secondary limiting factors. The Walla Walla Subbasin Plan indicates that obstructions associated with water diversions and the flood channel severely limit fish passage (NPPC 2004d).

Pine Creek MaSA

Pine Creek is a severely degraded system with numerous passage barriers, although a comprehensive inventory of barriers has not been done. A reproducing population of steelhead is not believed to exist in Pine Creek, however, anecdotal reports indicate that steelhead do occasionally ascend the creek (Bailey 2005). EDT analysis for Pine Creek indicated that sediment load, habitat diversity, flow, temperature, and fish passage obstructions were the primary limiting factors. Other limiting factors included key habitat quantity, channel stability, and food. Adverse effects from increased fine sediment levels are found primarily from river miles 1-5. EDT findings for Pine Creek, however, should be used cautiously as almost no supporting data were available to populate the model.

Cottonwood Creek MaSA

No data.

Walla Walla MaSA

The majority of the South Fork watershed is in a roadless area and supports some of the highest quality habitat in the region. Below forested areas, the river flows through agricultural lands comprised mainly of orchards and livestock pasture. Throughout the agricultural lands the river has been channelized to maximize the area available for agricultural use. EDT analysis for the South Fork Walla Walla indicates that habitat diversity and key habitat quantity are primary limiting factors. Channel stability, flow, sedimentation, and temperature were identified as secondary limiting factors, with most impacts occurring in the lower South Fork.

EDT analysis for the North Fork Walla Walla indicates that sedimentation, channel stability, flow, and habitat diversity are primary limiting factors. Temperature was identified as a secondary limiting factor.

EDT analysis for the upper mainstem Walla Walla identified low flow and habitat diversity as primary limiting factors. Channel stability, harassment, food, temperature, and obstructions were identified as secondary limiting factors.

Life Stages Affected

EDT modeling determined that sediment load, habitat diversity, flow, temperature, and fish passage obstructions were the primary limiting factors. Reduced habitat complexity suggests that stream systems lack LWD, cover, quality pools, and other characteristics that are necessary to support freshwater life stages for juvenile steelhead, as well as quality spawning habitat for adults. Elevated stream temperatures and low flows, found in the Walla Walla River and its tributaries, further reduce the quality and quantity of habitat for juveniles rearing. Elevated fine sediment loads and embedded substrates likely reduce spawning and incubation success. Fish passage obstructions delay pre-spawning fish and may inhibit upstream migrating juvenile fish from reaching suitable rearing habitat.

Viability Parameters Affected

Reductions in habitat complexity, increased summer water temperatures, and poor water quality have led to a decrease in the amount of juvenile rearing habitat available to MCR steelhead. Fish passage obstructions cause migration delays or prevent fish from spawning areas. Increases in fine sediment levels reduce egg-to-fry survival and reduce the amount of suitable spawning habitat. All of these factors cause reduction of productivity and abundance for these populations.

Currently there is insufficient information to determine the effect of habitat limiting factors on spatial structure and diversity for these populations.

Threats

Anthropogenic threats associated with these limiting factors include agricultural practices particularly irrigation, wetland draining and conversion, urban development, stream channelization and diking.

8.2 Hydrosystem-Related Limiting Factors

This section describes the current direct and delayed effects (limiting factors) of mainstem hydropower projects on ESA listed mid-Columbia steelhead originating from the Walla Walla, Umatilla, John Day, Deschutes, Hood River, and Fifteenmile Creek with the objective of establishing the relationship between juvenile and adult fish use and effects of mainstem habitat and construction and operation of the Federal Columbia River Power System (FCRPS). The primary focus is effects of mainstem flow and water quality, dam and fish facility operations on the abundance and productivity on mid-Columbia steelhead in Oregon's watersheds. The narrative includes a discussion how current actions under NOAA Fisheries 2004 FCRPS Biological Opinion (BiOp) affects the juvenile and smolt-to-adult return (SAR) of steelhead stocks and address each limiting factor on species recovery. In most cases, there was a lack of specific steelhead survival data for individual streams so we relied on research data from steelhead marked primarily from Snake and upper Columbia River stocks and run-at-large fish to generalize effects of the FCRPS on mid-Columbia steelhead.

8.2.1 Summary of Current FCRPS BiOp Operations and Actions Related to Mid Columbia Steelhead

As discussed in NOAA Fisheries "Mainstem Recovery Module", the FCRPS consists of 19 sets of dams, powerhouses, and reservoirs, operated as a coordinated system for power production and flood control by the Federal Action Agencies under various Congressional authorities. The principle projects are: Dworshak, Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams, power plants, and reservoirs in the Snake River basin; Albeni Falls, Hungry Horse, Libby, Grand Coulee and Banks Lake (features of the Columbia Basin Project), and Chief Joseph dams, power plants, and reservoirs in the upper Columbia River basin; and McNary, John Day, The Dalles, and Bonneville dams, power plants, and reservoirs in the lower Columbia River basin.

The plan for operation of the FCRPS through 2014 is described in U.S. Army Corps of Engineers (USACE) et al. (2004), the *Final Updated Proposed Action for the FCRPS Biological Opinion Remand* (UPA). In June 2005, the Federal District Court reviewed the *NOAA Fisheries 2004 Federal Columbia River Power System* (FCRPS) *Biological Opinion* (NOAA Fisheries 2004) in *National Wildlife Federation, et al., vs. National Marine Fisheries Service, et al.* The court ordered a remand of the NOAA Fisheries 2004 BiOp. Pending any court-ordered hydrosystem operational changes during the remand process, the FCRPS Action Agencies (i.e., USACE, USBR, and BPA) intend on implementing the actions identified in the 2004 BiOp and UPA. The following is a general summary of the hydrosystem actions included in the UPA and how these actions are currently limiting abundance/productivity of mid Columbia steelhead. Many of these actions are continuation of the RPA actions contained in the 2000 Biological Opinion.

- **Continue adult fish passage operations.** The Action Agencies will continue to complete a number of capital construction projects at federal dams to improve adult fish passage. Although these fish passage improvements have resulted in meeting or exceeding the adult fish survival performance standards set out in the 2000 BiOp, as discussed below there is concern that these standards do not adequately address delayed mortalityreduced spawning success effects from upstream passage (delay/fallback). Another issue is effects of reduced operation of adult passage facilities during winter maintenance that is especially critical for winter steelhead in the Hood River and 15 Mile Creek.

- **Improve juvenile fish passage.** Continue to implement specific capital improvements, giving priority for funding and implementation to dams with the lowest juvenile passage survival rates. New commitments to pursue removable spillway weirs (RSWs) or similar surface bypass devices, where feasible. RSWs are installed/planned for installation at all Snake River projects and feasibility studies are being conducted for RSWs at McNary and John Day dams and a forebay guidance device at The Dalles. These RSWs/surface bypass systems are currently designed to operate with reduced levels of conventional spill to provide similar or greater spillway passage and survival at a lower overall spill level to reduce operational costs. However, RSWs with greater training spill or multiple RSWs could be installed at projects to provide even higher spillway passage and survival.

- **Continue and enhance spill for juvenile fish passage.** Continue the basic spring and summer spill program from the 2004 BiOp. Under the 2004 BiOp remand, court-ordered summer spill was provided in 2005 at Snake River collector projects and McNary dam, which was designed to improve survival of listed Snake River fall Chinook.

- **Continue reservoir operations and flow augmentation to benefit migrating fish.** Continue to operate federal storage reservoirs to supplement streamflows and provide spill at mainstem dams to benefit juvenile fish migration consistent with current implementation of the 2000 BiOp as modified through implementation plans. The hydrosystem operation includes both discretionary and nondiscretionary actions. Under these operations, the Action Agencies operate federal storage projects at or near upper (flood control) rule curve elevations during the spring to pass spring runoff downstream and to help refill the projects by July 1st for summer flow augmentation operations.

- **Modify fish transportation to improve juvenile survival.** Continue to collect and transport juvenile fish at Lower Granite, Little Goose, Lower Monumental and McNary dams. Under the 2004 and previous Biological Opinions, spring migrants including mid Columbia steelhead are not transported during the spring April 10-June 30th spill period so transportation effects (only potentially applicable to Yakima and Walla Walla steelhead) are not considered aside the effects of transportation of upriver stocks on straying in mid Columbia tributaries.

8.2.2 Summary of the Effects of the FCRPS on Mid-Columbia Steelhead

As discussed, this narrative includes a discussion how current actions under NOAA Fisheries 2004 FCRPS Biological Opinion (BiOp) affects the juvenile and smolt-to-adult return (SAR) of steelhead stocks and address each limiting factor on species recovery. However, also as discussed, there is a lack of specific survival data for mid-Columbia steelhead, so we relied upon research data from juvenile steelhead marked primarily from Snake and upper Columbia River stocks and run-at-large juvenile and adult fish to generalize effects of the FCRPS on mid-Columbia steelhead. These data gaps need to be addressed by the TRT. Effects of the FCRPS are addressed in the following four categories:

1. Smolt-to-Adult Return (SAR) rates.
2. Juvenile migration and survival related to dam operations and river environment.
3. Delayed mortality associated with the FCRPS.
4. Adult migration and survival related to dam operations and river environment.

Smolt-to-Adult Return Rates

Smolt-to-adult return (SAR) rates provide a measure of survival that encompasses smolt migration, estuary/ocean residence, and adult return states. Changes in SAR over a number of years provide an index of temporal variability in stock productivity and viability and a basis to understand the relative effects of natural limiting factors in freshwater and marine environments, as well as effects of the FCRPS.

SAR data are only available for hatchery and wild steelhead in the Umatilla and Hood rivers. For Umatilla River wild steelhead, SARs for 1995-2002 migration years ranged from 0.01418 in 1996 to 0.05316 in 1998 with an average of 0.02570 for the eight-year period (Table 8-26).

Table 8-26. Smolt-to-adult return of Umatilla River wild summer steelhead at Three Mile Falls Dam for 1995-2002 migration years (White 2005). Data are incomplete for 2001and 2002 migration years.

Smolt Migration Year	No. of Smolts	No. Returns to TMFD	Smolt-to-Adult Return Rate (%)
1995	54361	837	1.540
1996	73361	1,040	1.418
1997	22221	1,026	4.615
1998	59182	3,146	5.316
1999	46530	2,299	4.941
2000	81759	4,045	4.948
2001	33844	1,135	3.353
2002	77016	1,649	2.141
2003	24773		
2004	35640		
2005	59807		
Mean =	**51,681**		**2.570**

For hatchery summer steelhead released in the Umatilla River from 1987-97 broods, SARs have ranged from 0.00043 for the 1988 brood to 0.00752 for the 1994 brood and averaged 0.0038 for the 11 years (Table 8-27).

Table 8-27. Smolt-to-adult return (hatchery release to Three Mile Falls Dam) of Umatilla Hatchery steelhead 1987-97 broods (Chess et al. 2005; Rowan 1998).

Brood Year	Rearing Location	No. CWT'ed	Total Released	Smolt-to-Adult Return Rate (%)	No. Adults Produced	No. Returns to TMFD
1987	Oak Springs Hatchery	58,067	61,306	0.437	374	268
1988	Oak Springs Hatchery	52,726	81,712	0.043	41	35
1989	Oak Springs Hatchery	56,034	89,193	0.704	838	628
1990	Oak Springs Hatchery	57,825	71,935	0.598	612	430
1991	Umatilla Hatchery	103,353	199,404	0.085	221	169
1992	Umatilla Hatchery	92,952	158,388	0.313	587	495
1993	Umatilla Hatchery	57,033	153,098	0.385	826	589
1994	Umatilla Hatchery	57,884	146,463	0.752	1372	1101
1995	Umatilla Hatchery	61,580	146,703	0.333	541	489
1996	Umatilla Hatchery	58,699	137,287	0.283	407	389
1997	Umatilla Hatchery	60,914	137,485	0.248	393	341
Mean =		**65,188**	**125,725**	**0.380**	**565**	**449**

For the Hood River, estimated SARs for combined wild summer and winter steelhead for 1994-2002 migration years ranged from 0.0368 for 1997 migration year to 0.1784 for 2001 and averaged 0.0900 for the nine years (Table 8-28**)**. Hatchery summer steelhead SARs for the same time period ranged from 0.0098-0.0452 with a mean of 0.0251 (Table 8-29). Hatchery winter steelhead SARs for the same time period ranged from 0.0064-0.0290 with a mean of 0.0178 (Table 8-30). Although not directly comparable, survival of hatchery summer and winter steelhead released from the Hood River have about four to five fold higher SARs (0.0194 summer and 0.0165 winter for 1992-97 brood or 1994-99 migration years) than the Umatilla (0.0039) Oregon Department of Fish and Wildlife (ODFW) contends that is likely due to additional mortality incurred from passage at three mainstem dams (John Day, The Dalles, and Bonneville) for Umatilla steelhead vs only one dam (Bonneville) for Hood River steelhead. Similarly, SARs of combined wild summer and winter steelhead in Hood River were about four fold higher than SARS of wild summer steelhead in the Umatilla River.

Table 8-28. Combined estimates of wild summer and winter steelhead subbasin smolt production, escapement to the mouth of the Hood River, and smolt to adult survival rate. Estimates are by year of migration. Year of migration is bold faced for those years in which estimates of adult escapements back to the mouth of the Hood River subbasin are greater than 97% complete (Olsen 2005).

Year of smolt migration	Smolts	Adult returns		Smolt-adult survival
		Run years[a]	No.[b]	
1994	7,573	1994/95-1999/00	538	7.10
1995	4,656	1995/96-2000/01	438	9.41
1996	6,799	1996/97-2001/02	400	5.88
1997	13,334	1997/97-2001/02	400	3.68
1998	25,485	1998/99-2003/04	491	6.16
1999	18,842	1999/00-2004/05	1,569	8.22
2000	14,882	2000/01-2004/05	1,979	13.30
2001	5,786	2001/02-2004/05	1,032	17.84
2002	8,096	2002/03-2004/05	765	9.45

[a] Summer steelhead escapements in the 2004-2005 run year are preliminary estimates through 31 December, 2004. Winter steelhead returns are complete through the 2003-2004 run year.

[b] Hooking mortality was assumed to average approximately 10% in the sport fishery located from the mouth of the Hood River to Powerdale Dam.

Table 8-29. Estimates of Foster and Hood River stock hatchery summer steelhead subbasin smolt production releases, adult escapements to the mouth of the Hood River, smolt-to-adult survival rate, and percent difference from the wild smolt-to-adult survival rate. Estimates are by year of migration. Year of migration is bold faced for those years in which estimates of adult escapements back to the mouth of the Hood River subbasin are more than 97% complete (Olsen 2005).

	Foster stock hatchery summer steelhead					Hood River stock hatchery summer steelhead				
		Adult Returns		Smolt to adult survival			Adult Returns		Smolt-to-adult survival	
Year of smolt migration	Smolts[a,b]	Run Years[c]	No.	Percent Survival	% from wild est.	Smolts[a,b]	Run Years[c]	No.	Percent Survival	% from wild est.
1994	90,042	1995/96-2000/01	2,051	2.28	-67.89	--	--	--	--	--
1995	76,330	1996/97/2001/02	1,010	1.32	-85.97	--	--	--	--	--
1996	68,378	1997/98-2002/03	673	0.98	-83.33	--	--	--	--	--
1997	60,993	1998/99-2003/04	600	0.98	-73.37	--	--	--	--	--
1998	64,910	1999/00-2004/05	1,624	2.5	-59.42	--	--	--	--	--
1999	62,218	2000/01-2004/05	2,208	3.55	-56.81	19,513	2000/01-2003/04	470	2.41	-70.68
2000	49,278	2001/02-2004/05	2,225	4.52	-66.02	33,899	2001/02-2004/05	1,253	3.7	-72.18
2001	62,354	2002/03-2004/05	1,777	2.85	-84.02	37,665	2002/03-2004/05	522	1.39	-92.21
2002	58,711	2003/04-2004/05	2,100	3.58	-62.12	45,658	2003/04-2004/05	1,154	2.53	-73.23

[a] Production releases of Foster stock hatchery summer steelhead smolts were direct released into the West Fork of the Hood River from 1994-1997. Annual production releases were made below Powerdale Dam (RM 4.5) beginning in 1998.

[b] Number represents the estimated hatchery smolt production release. Numbers have not been adjusted for residualism.

[c] Escapements in the 2004-2005 run year are preliminary estimates through 9 March, 2005.

[d] Hood River stock hatchery summer steelhead smolts were first released into the Hood River subbasin in 1999 (1998 brood). The entire production release is acclimated for up to two weeks prior to being volitionally released into the West Fork of the Hood River.

[e] Hood River stock summer steelhead were generally not available for harvest in the sport fishery through the 2003-2004 run year; with the exception of a small number of adipose-left maxillary clipped adults returning from the 2000 brood release (i.e., 29 adults). This was because of their unique hatchery mark combination (i.e., maxillary only clip). The 2002 brood release was the first brood release in which the entire production group was marked with an adipose clip; in combination with another mark (i.e., a maxillary clip). Hooking mortality of maxillary only clipped adults was assumed to average approximately 10% in the sport fishery located from the mouth of the Hood River to Powerdale Dam.

[f] Estimates include counts at Powerdale Dam of adult steelhead with a valid (i.e., for harvest) Hood River stock summer steelhead mark combination that were classified as a Hood River stock (Unknown) winter steelhead.

Table 8-30. Estimates of Hood River stock hatchery winter steelhead subbasin smolt production releases, adult escapements to the mouth of the Hood River, smolt-to-adult survival rate, and percent difference from the wild smolt-to-adult survival rate. Estimates are by year of migration. Year of migration is bold faced for those years in which estimates of adult escapements back to the mouth of the Hood River subbasin are more than 97% complete (Olsen 2005).

Release strategy, year of smolt migration		Adult returns		Smolt-adult survival	
	Smolts[a,b]	Run years	No.	Percent Survival	Diff. from wild (%)
Direct release,					
1994	38,034	1994/95-1998/99	682	1.79	-74.79
1995	4,656	1995/96-2000/01	1,023	2.39	-74.60
Acclimated,					
1996	6,799	1996/97-2001/02	580	1.14	-80.61
1997	13,334	1997/97-2001/02	385	0.64	-82.61
1998	25,485	1998/99-2003/04	651	1.05	-82.95
1999	18,842	1999/00-2004/05	1,355	2.9	-64.72
2000	14,882	2000/01-2004/05	1,724	2.73	-79.47
2001	5,786	2001/02-2004/05	720	1.42	-92.04
2002	8,096	2002/03-2004/05	1,220	1.94	-79.47

[a] Hood River stock hatchery winter steelhead smolts were first released into the Hood River subbasin in 1993 (1992 brood). The entire production release was first acclimated in 1996 (1995 brood). Hatchery smolts are acclimated for up to two weeks prior to being volitionally released into both the East and Middle forks of the Hood River.

[b] Number represents estimated smolt release. Numbers have not been adjusted for residualism.

[c] Number includes counts at Powerdale Dam of adult steelhead with a valid Hood River stock winter steelhead mark combination that were classified as a Hood River (Unknown) stock summer steelhead.

Juvenile Migration and Survival Related to Dam Operations and River Environment

This section presents juvenile migration and survival data applicable to Mid-Columbia steelhead and how migration and survival are affected by dam operations (primarily spill), environmental parameters (primarily flow and temperature), and predation.

Juvenile Survival

There is inadequate data to estimate juvenile survival of Mid-Columbia steelhead because very few of these fish have been PIT-tagged. A query of the PIT-tag data base (see below) indicates that only a few wild steelhead have been PIT-tagged are and limited to only the Umatilla, John Day, Wind, and Hood rivers. There are data from PIT-tagged steelhead from the Snake River to estimate survival through mid-Columbia dams (McNary to Bonneville) that at least provides some data on what survival might be expected for mid Columbia stocks. Additional tagging is needed, however of specific mid-Columbia stocks to corroborate results. Data were not sufficient to estimate juvenile steelhead survival from McNary to Bonneville until 1997 and only for pooled wild and hatchery steelhead (Table 8-31). Annual estimates ranged from 0.250 in 2001 to 0.770 in 1998 and averaged 0.540 for the seven years. These survival estimates include only direct effects of passage through the mid-Columbia dams and reservoirs; delayed mortality from hydrosystem passage for these fish is an effect that warrants investigation by the TRT related to mid Columbia steelhead (see below). Delayed mortality due to hydrosystem passage has been thoroughly documented for Snake River spring/summer Chinook (Marmorek et al. 2004) (see below) and potentially a major constraint to recovery of probably all Snake River as well as mid Columbia ESUs. Similarly, Williams concluded that some level of latent mortality exists. NOAA Fisheries believes we have very limited capability to precisely estimate the overall magnitude of hydropower system-related latent mortality for either transported fish or nondetected in-river migrants (Williams et al 2005).

These annual survival rates are influenced by dam operations (spill) as well as migration rate (as influenced by flow) temperature (see below), and predation. Survival in 2001 was only about one-third of 1998, due to extremely low flows, high temperatures, and limited spill at each dam due to a declared power emergency by BPA.

Table 8-31. Estimated survival from McNary Dam tailrace to Bonneville Dam tailrace for hatchery and wild steelhead (pooled) PIT tagged from the Snake River (from Williams et al. 2005).

Year	Survival	Standard Error
1997	.651	.082
1998	.770	.081
1999	.640	.024
2000	.580	.047
2001	.250	.016
2002	.488	.090
2003	.510	.015
Average	**.540**	**.071**

Survival data are also available for 1999-2005 for wild summer steelhead from release in the Umatilla River to John Day Dam (Table 8-32) that includes effects in the Umatilla River and also passage through John Day reservoir. Survival probabilities were lowest in 2001 and 2004, two below normal flow years in both the Umatilla and Columbia rivers. As discussed below, flow, spill, and temperature are thought to be key operational and environmental parameters that influence survival of mid Columbia steelhead.

Table 8-32. SURPH generated survival and capture probabilities for natural summer steelhead tagged and released into the Umatilla River, 1999 – 2005 (White 2005).

	Survival probabilities			Capture probabilities		Final S*P		
Year	TMFD	TMFD to JDD	JDD	TMFD	JDD	TMFD	JDD	Number tagged
				All fish tagged and released in Upper Basin[a]				
1999	0.26	0.75	0.19	0.32	0.42	0.40	0.19	2010
2000	0.34	0.52	0.18	0.34	0.34	0.25	0.22	1652
2001	0.39	0.38	0.15	0.15	0.53	0.27	0.36	2622
				Fish tagged and released from January - June in Upper Basin[ab]				
2000	0.37	0.57	0.21	0.36	0.29	0.24	0.18	1281
2001	0.40	0.37	0.15	0.15	0.53	0.26	0.36	2480
				Fish tagged at TMFD for Trap Efficiency tests[c]				
1999	0.97	0.69	0.67	0.21	0.37		0.20	1845
2000	--	--	--	--	--	--	--	24
2001	0.75	0.53	0.40	0.35	0.25		0.21	281
2002	1.04	0.61	0.64	0.17	0.30		0.14	468
2003	0.80	0.64	0.51	0.18	0.40		0.32	498
2004	0.84	0.44	0.37	0.43	0.39		0.13	309
2005	0.91	0.54	0.49	0.29	0.41		0.10	704

[a] These fish were tagged at various times and released at various upriver sites (RM 48 – RM 80) but were grouped for species survival. Natural fish were only tagged from 1999 to 2001.
[b] Fish tagged from January to June were assumed to be actively migrating smolts. These fish were separated because of the potential for overwintering mortality associated with fish tagged from July to December.
[c] These fish were released about 1.5 miles upstream of TMFD at various times.

Migration Timing

Migration timing for wild mid Columbia steelhead in the mainstem as determined by detection of PIT tagged fish is limited to wild and hatchery steelhead PIT tagged in the Umatilla River where adequate numbers have been PIT tagged since 2001. PIT tagging of wild steelhead has been initiated in the John Day, Wind and Hood rivers but inadequate numbers have been detected at mainstem dams to determine migration timing. We summarized migration timing of Umatilla River wild and hatchery PIT tagged steelhead detected at John Day dam 2001-2005 (Figures 8-5--8-9); except for 2001, Umatilla steelhead passed John Day dam during April and May, typical of migration timing of steelhead PIT tagged in the Snake and upper Columbia rivers (FPC 2005). In 2001 due to drought and power emergency (limited spill) conditions, Umatilla steelhead migrations extended into August (Table 8-32).

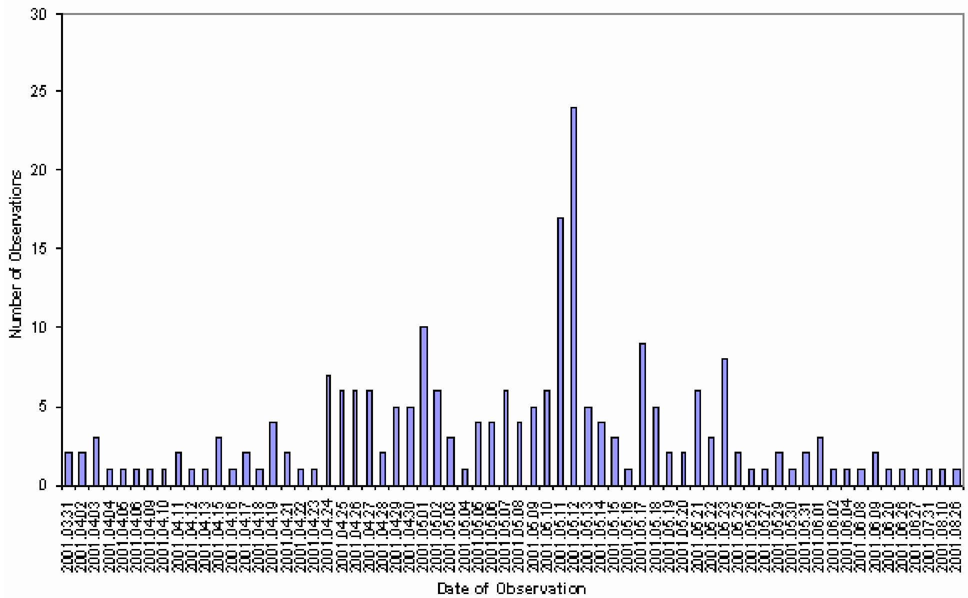


Figure 8-5. Migration timing of wild PIT-tagged Umatilla River steelhead at John Day Dam in 2001.

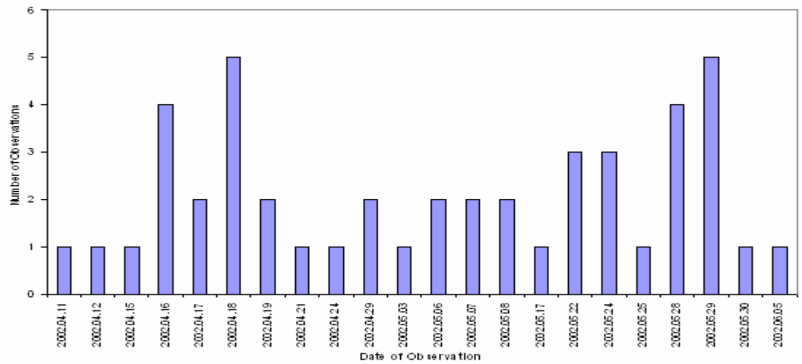


Figure 8-6. Migration timing of wild PIT-tagged Umatilla River steelhead at John Day Dam in 2002.

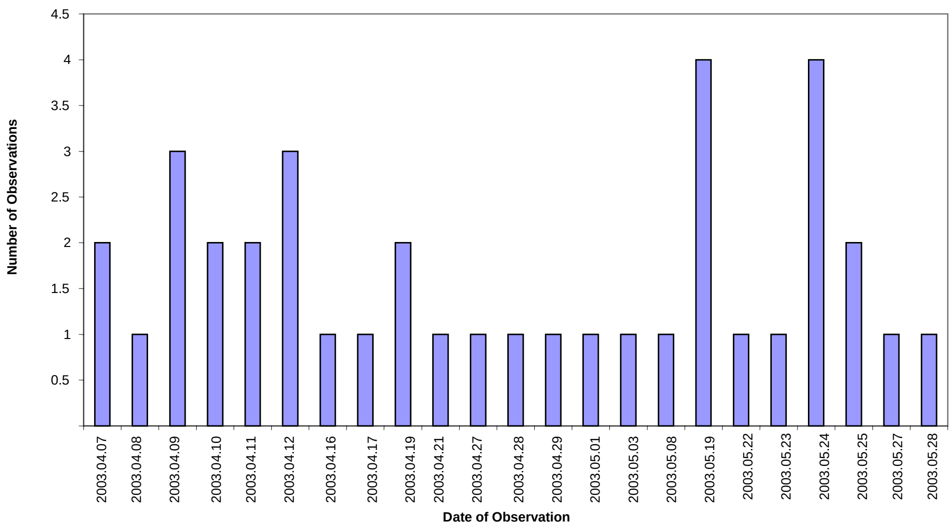


Figure 8-7. Migration timing of wild PIT-tagged Umatilla River steelhead at John Day Dam in 2003.

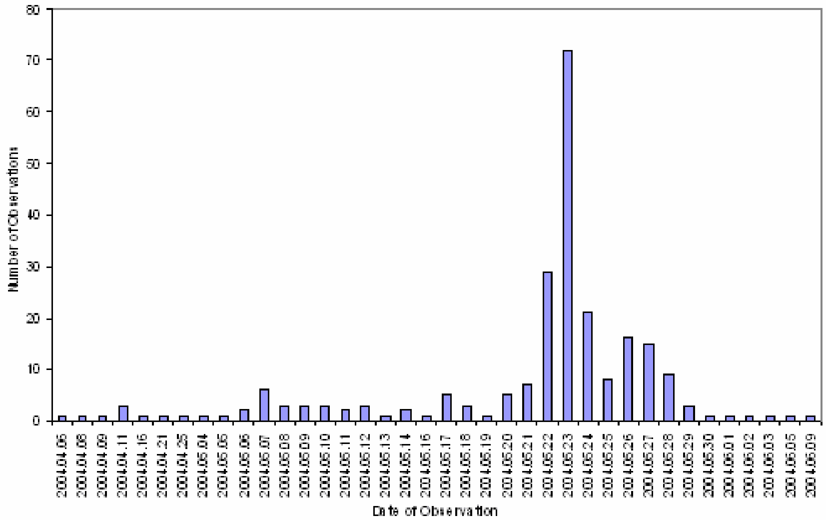


Figure 8-8. Migration timing of wild PIT-tagged Umatilla River steelhead at John Day Dam in 2004.

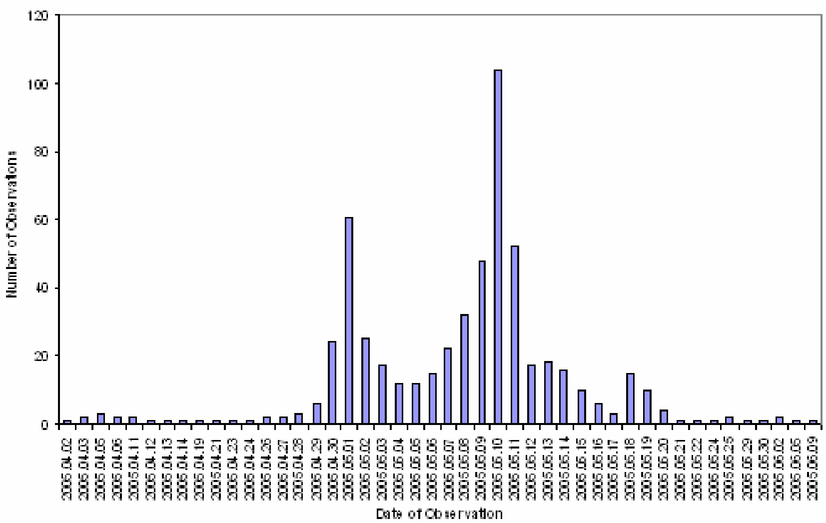


Figure 8-9. Migration timing of wild PIT-tagged Umatilla River steelhead at John Day Dam in 2005.

Juvenile survival related to dam operations and river environment

The relationship between mid-Columbia steelhead migration and survival related flow, spill, and river conditions in the mainstem Columbia is unknown due to inadequate PIT-tagging of mid-Columbia steelhead to statistically relate migration rate (travel time) and survival to flow, spill, temperature, and other river conditions. However, analyses have been conducted by the Fish Passage Center and NOAA Fisheries establishing these relationships for steelhead PIT-tagged from the Snake River (where most PIT-tagging to date has been conducted) for the McNary to Bonneville index reach. These findings cannot be directly extrapolated to Mid-Columbia steelhead but at least provides a basis for understanding probable environmental and dam operational conditions that might be limiting survival and viability of Mid-Columbia steelhead and help identify future research to corroborate results.

The Fish Passage Center (FPC 2005) found statistically significant relationships between survival of PIT tagged steelhead from McNary to Bonneville dams during 1999-2005 and spill (Figure 8-10), water transit time (related to flow) (Figure 8-11) and temperature (Figure 8-12). Pearson's correlation matrix for these analyses are provided in Table 8-33. Although these relationships were highly influenced by a single low flow year (2001), they still suggest that survival of steelhead is influenced by the amount of spill, flow, and temperature at mid Columbia dams with higher survival at higher spill and flow and lower water temperatures. It should be noted that these results are similar to that found for yearling Chinook between McNary to Bonneville (FPC 2005) and for yearling Chinook and steelhead between Lower Granite to McNary dams (FPC 2005) where greater sample sizes and observations over a wider range of dam operations and environmental conditions allow greater statistical rigor and strength of relationships.

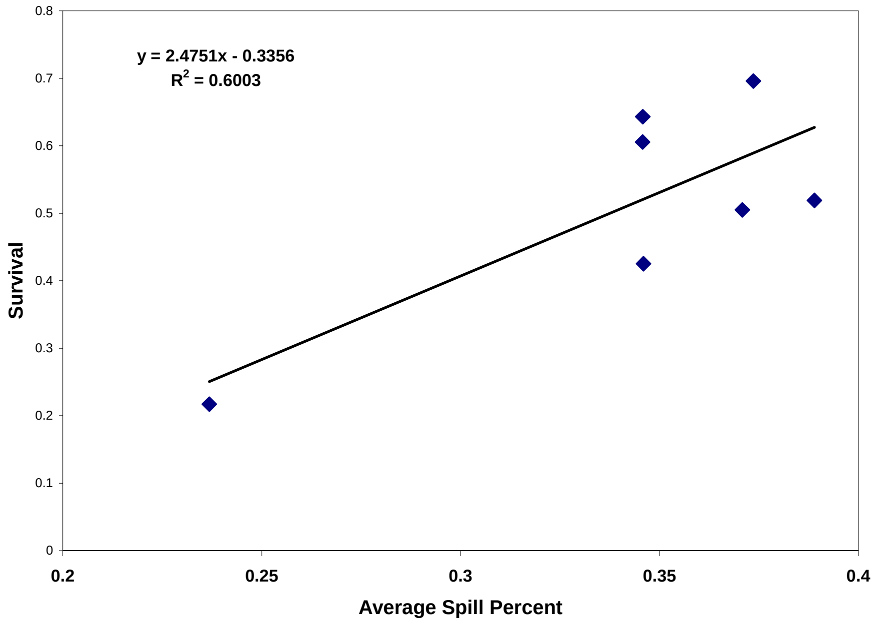


Figure 8-10. Reach survival from McNary Dam to Bonneville Dam for PIT-tagged steelhead detected at McNary Dam between May 11 and June 8 for years 1999 to 2005 plotted with average spill percent at John Day, The Dalles and Bonneville dams.

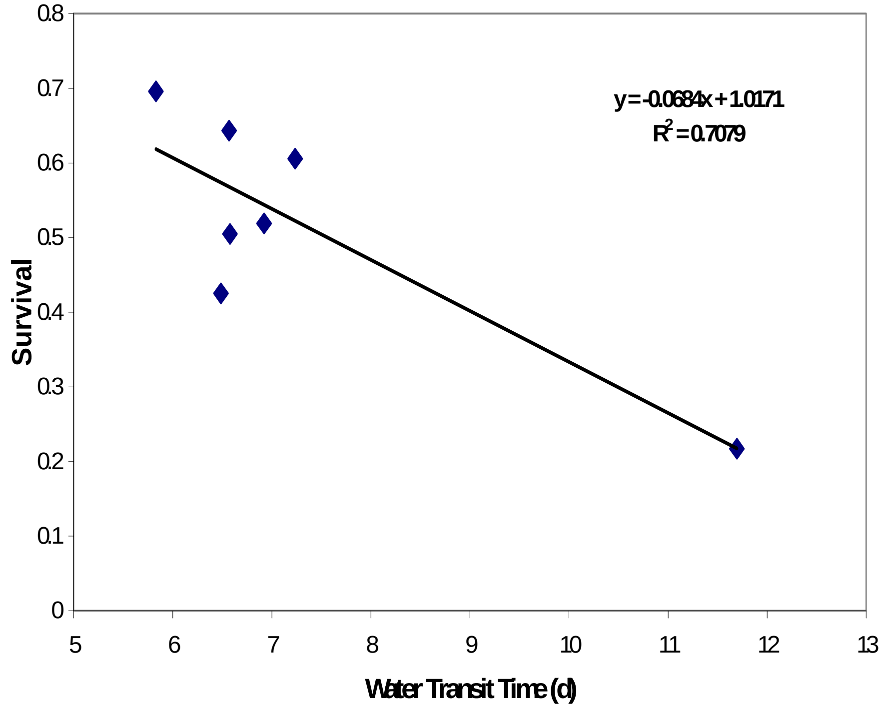


Figure 8-11. Reach survival from McNary Dam to Bonneville Dam for PIT-tagged steelhead detected at McNary Dam between May 11 and June 8 for years 1999 to 2005 plotted with average water transit time for the reach McNary Dam to Bonneville Dam.

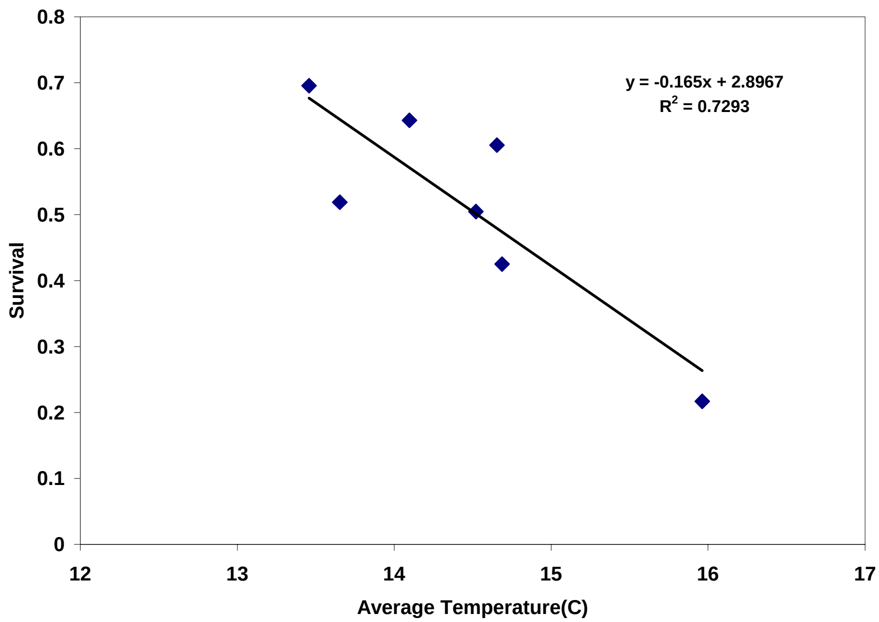


Figure 8-12. Reach survival from McNary Dam to Bonneville Dam for PIT-tagged steelhead detected at McNary Dam between May 11 and June 8 for years 1999 to 2005 plotted with average water temperature(C) measured at tailwater TDGS monitors for the reach McNary Dam to Bonneville Dam.

Table 8-33. Pearson correlation matrix for Snake River steelhead survival relationships.

	SURVIVAL	TRAVTIME	WTT	AVGSPILL	AVTEMP
SURVIVAL	1.00000				
TRAVTIME	-0.76894	1.00000			
WTT	-0.84138	0.96015	1.00000		
AVGSPILL	0.77482	-0.92923	-0.93281	1.00000	
AVTEMP	-0.85401	0.87935	0.85638	-0.90103	1.00000

Latent Mortality Associated with the FCRPS

There are conflicting hypotheses on the degree of latent mortality attributable to the passage of fish through the hydropower system. Williams concludes that clearly some level of latent mortality exists. However, NOAA Fisheries believes we have very limited capability to precisely estimate the overall magnitude of hydropower system-related latent mortality for either transported fish or nondetected in-river migrants. Certainly we have much stronger evidence for substantial latent mortality of transported fish. For in-river migrants, and based on the likely disruption of historical migration-timing patterns, an assumption that some level of latent mortality exists is reasonable. So, we are left with the rather unsatisfying range of conclusions that for in-river migrants, hydropower system-related latent mortality ranges somewhere from very weak to potentially strong. Further, we have little data at present to discern among this broad range of alternatives (Williams et al 2005). Others contend that comparing SARs of Snake River spring/summer chinook and steelhead with estimates of survival through the FCRPS (both juvenile downstream and adult upstream direct survival estimates) indicates that the majority of mortality of both inriver and transported fish occurs outside the hydrosystem manifested as "delayed" mortality (Marmorek et al. 2004). Studies and analyses have been conducted over the last 10 years to identify causative mechanisms including changes in migration timing (from delay of inriver smolts and acceleration of transported smolts), disease transmission or stress resulting from concentration of fish in bypass/transportation facilities, depletion of energy reserves due to prolonged migrations, altered estuary/plume characteristics, and disruption of homing instincts. The Comparative Survival Study (CSS) Workshop (Marmorek et al. 2004) found that results from updated modeling (Delta model used by Deriso et al. 2001), that in contrast to conclusions reached by Williams et al. (2000), delayed mortality for Snake River spring/summer Chinook has remained high in recent years (long-term average=0.81) despite improvements in ocean conditions.

The CSS Workshop evaluated evidence of several mechanisms of delayed mortality including several that are directly applicable to mid Columbia steelhead:

- *The hydrosystem indirectly affects SARs by delaying inriver arrival of smolts in the estuary*- Snake River steelhead arrive in the estuary 2-3 weeks later than historically (travel times greatly extended due to reduced water particle time from dam construction) that influence availability of prey that might be key in estuary/early ocean survival. Although delay of mid Columbia steelhead may not be as great as Snake River stocks, any delay may affect survival.

- *The hydrosystem indirectly affects SARs by delaying the smolt development process through altered entry timing and stress*- Similar to Snake River stocks, mid Columbia steelhead may be stressed from hydrosystem passage and reverse in smolt development decreasing overall survival.

- *The hydrosystem indirectly affects SARs through size selectivity and annual variation in bypass survival*- Although thought to a key hypothesis (Williams et al. 2005), a re-analysis of data by Marmorek et al. (2004) for Snake River wild Chinook showed a weak trend in size selectivity and only at Little Goose Dam. Bypass passage for mid

Columbia steelhead is probably less of a factor than for upriver stocks due to less bypass systems encountered (most stocks are affected by only two dams, John Day and Bonneville, as there is no bypass at The Dalles).

- *Smolt passage through the hydrosystem increases stress, reduces growth rate and fish condition that increases vulnerability to mortality factors including predation and horizontal transmission of pathogens***-** This hypothesis is likely but uncertain as evidence is mainly from laboratory studies and lack of empirical data confirming results.

Adult Migration and Survival Related to Dam Operations and River Environment

The following is a summary research of radio tagged adult salmon and steelhead by the University of Idaho and NOAA Fisheries conducted since 1996 provided by Dr. Chris Peery, University of Idaho. Although the focus of the research was primarily passage of adult Snake River salmon and steelhead, the findings are applicable to mid Columbia steelhead in identifying key limiting factors.

During this period, more than 18,000 fish have been radio-tagged, monitored and the fates of individual fish have been assessed. Monitored groups have included spring, summer, and fall Chinook salmon, steelhead, and sockeye salmon. Samples from later years have included adults that were PIT-tagged as juveniles at known locations, allowing us to assess behavior and survival for individuals with known homing destinations. The tagging program has included several ESA-listed stocks including limited mid Columbia steelhead (primarily Umatilla and John Day steelhead). Additional information related to research results described here can be found at, http://www.cnr.uidaho.edu/uiferl/.

Survival, Harvest, and Pre-Spawn Mortality

Survival. Survival through the Columbia River Hydrosystem (Bonneville Dam to Lower Granite or Priest Rapids dams) averaged 73% for spring–summer Chinook salmon, 61% for fall Chinook salmon, and 63% for steelhead and can vary significantly among years (Figure 8-13). Fish that do not reach spawning areas are lost to harvest and other causes. Survival of mid Columbia steelhead is likely to be higher due to less dams encountered. Lately, losses to predation from pinnipeds downstream from Bonneville Dam, and late (delayed) migration mortality upstream from the hydrosystem (including to tributaries) have been areas of concern.

Harvest. Harvest in the main stem Columbia and Snake rivers have averaged 9% for spring–summer Chinook salmon, 22% for fall Chinook salmon, and 15% for steelhead. An additional 3–6% of radio-tagged fish have been harvested in lower river tributaries. These estimates should be considered minimums, because harvest reports have been voluntary, with reward incentives. Although considerable effort has been invested in monitoring harvest, accurate estimates are difficult to collect and verify. Unreported and illegal harvest does occur in the basin. Delayed mortality associated with fisheries (i.e., following sport releases, contacts with gill nets, etc.) has not been well studied.

Non-Harvest Mortality. After accounting for fishing mortality, an average of 12–17% of Columbia River and Snake River salmon and steelhead adults had unknown fates before reaching spawning tributaries or exiting the monitored hydrosystem. Causes for these mortalities are unknown, but likely include extended migrations, stress from elevated water temperatures, energetic exhaustion, disease, unreported harvest, delayed mortality due to injuries sustained during fallback or from encounters with fisheries, or other factors. An important finding applicable to mid Columbia steelhead is survival for all runs has tended to be lowest in the lower Columbia River (Bonneville to McNary) and higher through lower Snake River reaches. Factors correlated with fish loss are discussed in more detail below

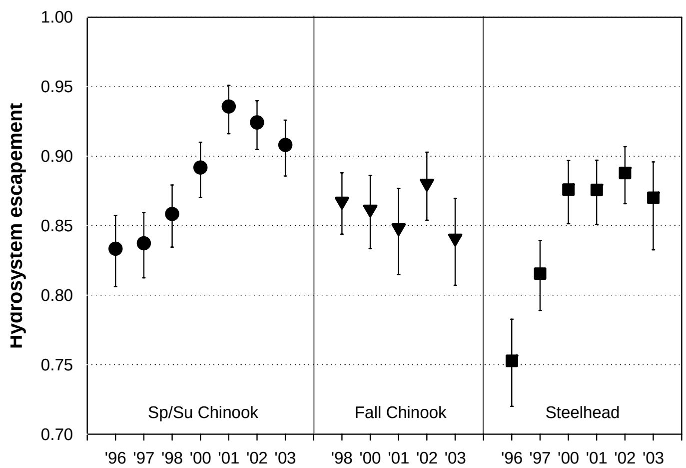


Figure 8-13. Average escapement for adult spring/summer Chinook salmon, fall Chinook salmon, and steelhead through the Federal Columbia River Power System, adjusted for known commercial and sport harvests.

Pinnipeds. The proportion of adult salmonids consumed by pinnipeds in the near vicinity of Bonneville Dam during spring (1 January to 31 May) has trended upward; 0.3%, 1.1%, 2.0%, 3.4% during the four years 2002-2005, as reported by USACE Fish Biologist Robert Stansell. Actual population level impact from pinniped predation on salmon is difficult to estimate because predation levels downstream from Bonneville have not been documented but is likely to be substantial.

Pre-Spawn Mortality. Additional mortality occurs upstream from the hydrosystem and prior to spawning, but quantitative summaries of these components of adult survival are conspicuously limited. Intensive surveys of spawning areas in the South Fork Salmon River, Idaho, reveal 25 to 60% of successful Chinook salmon migrants die before spawning each year compared to numbers observed at Lower Granite. A study is underway to determine how migration history, water temperatures in and upstream from the hydrosystem, and fish energetics are related to pre-spawn mortality for this population. Similar studies are needed for mid Columbia steelhead.

Straying. Permanent inter-basin straying is a challenging component of assessing adult survival because they could be considered either successful migrants (they reached a spawning area) or unsuccessful migrants (they did not home to their natal site). On average, 2–4% of known-origin spring–summer and fall Chinook salmon and 7% of steelhead in the radiotelemetry study strayed into non-natal basins where they may have spawned with native stocks. Hatchery fish and fish transported (barged) from the Snake River as juveniles were more likely than other groups to stray. Many stray steelhead from the Snake River entered the Deschutes and John Day rivers and possibly spawn with native populations.

Wandering. In warm years and during warm periods within years, large proportions of summer and fall Chinook salmon and steelhead runs encounter temperatures considered stressful for salmonids. In response, many fish seek cool thermal refuges—and particularly cool non-natal tributary streams particularly the Deschutes River. During the warmest times, majorities of the fall Chinook and steelhead runs concentrate in these refugia, where they may be highly vulnerable to harvest. While the behavior likely has immediate energetic benefits, delays and elevated harvest risks during warm water periods may lead to overall decreases in system productivity. There is some evidence that survival consequences of high temperature exposure may be greater for obligatory migrants like Chinook salmon than for steelhead, which migrate many months in advance of spawning.

Effects of Dams and Operations

*Passage Rates***.** Most adult salmon and steelhead pass individual dams in 1 to 2 days, and pass quickly through reservoirs. However, a proportion of each run (typically between 2–12%) has taken several days to weeks to pass individual dams. Fish that take a relatively long time to pass individual dams were less likely to migrate successfully to spawning tributaries. Similarly, relatively slow passage through the lower Columbia hydrosystem (multiple dams and reservoirs) from McNary to Bonneville was associated with unsuccessful migration. Though causation is unknown , the association described above may have resulted from inadequate dam passage facilities 'delaying' some individuals, the expenditure of large amounts of energetic stores, and resulting in premature death. Alternatively, individuals in poor condition at river-entry may have been both slow and less likely to reach spawning grounds, regardless of passage conditions at dams. Studies are on-going to determine the relative roles of these two mechanisms. Improving passage efficiency has been a management goal, and incremental improvements to fishways (transition pools, count windows, entrance and exit conditions) and operations (spill, fishway temperatures) are being studied and implemented.

Fallback. Some fish from all runs pass dams and then fall back downstream. Approximately 22% of spring–summer Chinook salmon, 15% of fall Chinook salmon, and 21% of steelhead fell back at one or more dams during migration. Fallback is associated with both direct and delayed mortality, slowed migration rates, and increased likelihood of straying. Fallback rates have been highest in years with high river flow and high spill at dams, at least in part because most fish fall back via dam spillways. Fish also appear to fall back as a result of orientation errors, including failure to locate natal tributaries and imprinting problems associated with juvenile barging. Providing benign downstream passage routes for these individuals could lessen the survival costs of fallback. Operational changes may help reduce fallback and therefore increase overall survival, but it is unclear how large a reduction is possible given the management constraints.

Juvenile Barging. Currently, about 70% of juvenile migrating seaward in the Snake River are collected and transported by barge below Bonneville Dam. Returning adults which had been barged as juveniles were ~10% less likely to migrate to spawning grounds, exhibited less direct migrations, and strayed to non-natal tributaries (ex: Deschutes River) at rates that were approximately twice that of adults that had migrated in the river as juveniles. Barging probably interrupts the 'sequential imprinting' process whereby adults use olfactory memories from the juvenile seaward migration during homing. It should be noted that fish used in this study are captured at the Washington shore fish trap which may have influenced results.

Spill. Results three years when spill levels were manipulated at Bonneville Dam suggest that high spill volumes (>100 to kcfs at Bonneville) increase adult passage times slightly compared to moderate spill volumes of ~75 kcfs. Higher spill was also associated with higher fallback rates in spring Chinook salmon and in steelhead. As already noted, longer passage times and fallback events have been associated with lower survival for individual fish.

Summer Spill. Preliminary results from the adult radiotelemetry project suggest that moderate spill during summer would likely have only a limited impact on adult passage. Summer Chinook salmon also exhibited slight increases in passage time and fallback rate at high spill levels at Bonneville dam. However, these effects should be weighted against the potential benefits of limited spill for those adults that volitionally fallback (i.e. those that overshot natal tributaries) because fallback via spillways is more benign than through turbines.

Fishway Temperatures. Elevated water temperatures and large temperature differentials (between the top and bottom of ladders) in dam fishways can deter passage. Mean passage times for spring-summer Chinook at Lower Granite Dam increased from 6.6 hours when temperatures at the ladder exit were similar to those at the base of the ladder, to 19.1 hours when exit temperatures were ≥ 2˚C warmer than at the base. Similarly, the proportion of fish requiring more than one day to pass the dam increased from 32.7% with no temperature barrier to 71.4% when temperatures differed by ≥ 2˚C. Greater numbers of fish reject fishways at John Day Dam when water temperatures exceed 18ºC. Temporary temperature barriers contribute to adult passage delay that may result in permanent straying to downstream sites or migration failure.

Dissolved Gas. High spill at dams can create supersaturated dissolved gas condition in tailraces and downstream areas, and there is concern that fish that encounter these conditions may develop gas bubble disease. Results from an archival tag study that monitored fish swimming depths suggest that adults do not avoid plumes of high dissolved gas and frequently experience high dissolved gas conditions. However, most adults remained at depths that provided adequate "hydrostatic compensation" and consequently prevented expression of gas bubble disease. Little is known about the effects of the observed frequent, but short, exposures to supersaturated conditions. Addition of flow deflectors and increased use of surface flow weirs at spillways should moderate dissolved gas conditions in the system. Additional study of this issue may be warranted given the incidence of gas bubble disease symptoms in adults in some years.

River and Ocean Environment

Flow and Survival. Adult Chinook salmon appear to have lower hydrosystem survival in years with high flow (discharge). This pattern is probably the result of higher fallback and slower migration rates in high-flow years, two energetically demanding aspects of migration. Survival for runs that migrate during typical low-flow times (most fall Chinook salmon and steelhead) has not been correlated with river flow.

Temperature and Survival. Water temperatures in the Columbia and Snake Rivers have been increasing since dam construction began due to development and management of the hydrosystem as well as from regional climate and water use patterns, resulting in longer summers and higher summer temperatures. Adults returning in the late spring, during summer, and in the early fall frequently choose the coolest water available to them to migrate in, but still frequently encounter stressful temperatures. Higher temperatures were associated with altered migration behavior and lower migration success. Predictions for continued warming will probably adversely affect migrating adults because migration through stressful temperature conditions requires more energy and may contribute to higher rates of prespawn mortality. A study is underway to evaluate effects of temperature exposure on gamete quality and spawning success.

Temperature and Straying/Wandering Behavior. Interactions between river temperatures and wandering/straying behaviors were outlined above. Use of non-natal cool-water refugia will continue and possibly increase if current temperature trends persist. Managers should be aware of the use of cool-water refugia streams relative to habitat and fisheries management actions for these areas.

Ocean Conditions. Ocean conditions have strong effects on salmon. A future downturn in ocean conditions may be associated with a downturn in adult condition with subsequent effects on adult performance. Efforts are underway to evaluate effects of ocean conditions and initial fish energetic state on migration and reproductive success.

Straying. High water temperatures, juvenile barging, and fallback at dams have all been associated with increased straying by adult salmon and steelhead. Straying is an important management concern in the basin, due to the potential for increased interbreeding between ESA-listed stocks and non-listed stocks, especially those of hatchery origin. Potential effects of hatchery strays are addressed in Section 8.4.

8.3 Harvest-Related Limiting Factors

This section explains the different types of fishery impacts, the types of fisheries and areas that Mid-Columbia River steelhead fisheries occur, and the multitude of jurisdictions and processes that influence the fish. The section also provides perspective on historic and current harvest impacts.

Harvest may affect population viability by affecting abundance, productivity, spatial structure and/or diversity. Harvest decreases survival rates relative to an un-harvested population by removing fish. In steelhead, fish may be removed at several life stages, ranging from pre-smolts taken in trout fisheries, to adults taken after they have returned to natal tributaries to spawn. Harvest, therefore, directly decreases adult abundance (viewed either as the number of spawners or as the number of adult recruits) and productivity, measured as the number of adult recruits per spawner returning to the spawning ground. The extent of this decrease in abundance is usually reported as a harvest rate.

Harvest also may be selective and influence diversity and spatial structure viability criteria. Harvest may selectively remove fish based on size, age, distribution or run timing, depending on the gear, timing and location of the fishery. Selectivity impacts have rarely been measured or reported.

Steelhead may be caught in ocean, mainstem Columbia River, or tributary fisheries depending on their distribution, run timing relative to fishery openings and vulnerability to gear. It is generally assumed that steelhead are rarely caught in ocean fisheries. There has been no direct freshwater non-tribal harvest on wild steelhead from the Mid-Columbia ESU since 1992 when the last wild fish catch-and release regulations on these populations became effective. Therefore, all current non-tribal harvest impacts on Mid-Columbia ESU steelhead are due to incidental by-catch in commercial or recreational fisheries that target hatchery steelhead or other species. Tribal fishers in Zone 6 of the Columbia mainstem (between Bonneville Dam and McNary Dam) continue to retain wild steelhead for commercial sale or for personal use.

8.3.1 History

Because of their exposure to fisheries across large geographic regions of the West Coast, Pacific salmon and steelhead management is governed by a number of regional organizations. Fisheries of the Columbia River are established within the guidelines and constraints of the Pacific Salmon Treaty, the Columbia River Fish Management Plan, the Endangered Species Act administered by NOAA Fisheries, The Pacific Fishery Management Council, the states of Oregon and Washington, the Columbia River Compact, and management agreements negotiated between the parties to US v. Oregon.

Fisheries management through these various organizations has resulted in the decline of total exploitation rates for Columbia River salmon and steelhead, especially since the 1970s. The impact of these various fisheries is discussed below.

Ocean

Columbia River steelhead have been captured in high-seas sampling in the far North Pacific and along the coast of SE Alaska and British Columbia (Burgner et al. 1992). According to Rich (1942), Columbia River steelhead were historically taken along with Chinook and coho in ocean fisheries off the mouth of the Columbia River, but accounted for less than 0.1% of the catch and numbered only in the few hundreds of fish. More recent ocean commercial fisheries have not been monitored for incidental steelhead by-catch, and it is assumed that by-catch was very low. Recreational fisheries in the ocean catch small numbers of steelhead.

Mainstem Commercial

Steelhead catch in Columbia River mainstem commercial fisheries was reported starting in 1889, although it is thought that some steelhead were processed along with chinook (and counted as Chinook) in previous years. The available information is mostly about summer steelhead catch since early reporting focused on the fall fishery, but earlier spring fisheries probably caught some winter steelhead. The maximum annual catch reported was about 492,000 fish (Figure 8-14) (Craig and Hacker 1940). Annual catches were averaging about 189,000 fish by the 1930s. Escapements were not estimated before the late 1930s so the harvest rates due to these early fisheries were not known. All early catch was of wild steelhead.

The Bonneville Dam fish ladder opened in 1938 and allowed escapement estimates to be made on populations that passed above that location. Rich (1942) estimated that the 1938 harvest rate on up-river steelhead was 67%, with 80% of the catch occurring below Bonneville Dam. Subsequent harvest records indicate that commercial harvest rates on up-river steelhead were about 66% between 1938 and 1950 (Figure 8-15) (WDFW and ODFW 2002). Most of the harvest was probably of summer steelhead. Winter steelhead were not identified as a separate race until 1953. From 1939 through 1950, about 8% of the steelhead passing the dam were probably winter steelhead based on run timing.

Total mainstem commercial harvest rates on steelhead (tribal and non-tribal combined) began to decline in the 1950s, and also began to include a mix of hatchery and wild fish. Mainstem harvest rates on up-river summer steelhead declined from about 50% to about 20% from the early 1950s to the early 1970s, while winter steelhead harvest rates declined from about 30% to about 5% over the same period. Non-tribal mainstem commercial fisheries on steelhead were discontinued in 1975. Subsequent impacts in the non-tribal commercial fishery were due to by-catch during fisheries on other species. All steelhead were released in these fisheries, although some release mortality occurred. Tribal commercial harvests in Zone 6 since 1975 ranged from about 30% to less than 10% (Figure 8-15).

Mainstem Recreational

Mainstem recreational fisheries below Bonneville Dam have been monitored by creels since 1964. The harvest rate on summer steelhead ranged from over 16% to less than 1% until 1992 when all fisheries became catch-and-release for wild fish. The harvest rate on winter steelhead over the same period ranged from 2% to less than 1%. Current recreational harvest impacts for both life histories are estimated to be less than 1% and are due entirely to hooking mortality.

Recreational fisheries in the mainstem above Bonneville Dam are not monitored, except by punch card estimates. Bubble fisheries at the mouths of some tributaries can be seasonally intense, but the impact rates are unknown except for a bubble fishery at the mouth of the Deschutes. These fisheries have also been catch-and-release since 1992 and impacts to wild fish are thought to be less than 1%.

Tributary Recreational

Recreational fisheries in tributaries historically targeted both adult steelhead and redband trout. The trout fisheries may have included take of pre-smolt steelhead. Historic tributary fisheries have been monitored by punch cards since 1956, however, punch card records are believed to over estimate harvest for various reasons. While historic tributary harvest rates are considered to be poorly documented, they probably ranged from 20% to 60% depending on the location and year.

By 1992, catch-and-release regulations were in place in all Oregon tributary steelhead fisheries. Subsequent harvest impacts on wild fish were the result of release mortalities in fisheries that were targeting hatchery fish. Some areas were completely closed to steelhead fishing in some years. Creels were implemented in the lower Deschutes and Umatilla in the 1990s and improved documentation of wild fish handle. These management changes were thought to have dropped tributary harvest impacts on wild fish to between 0% and 1.5%.

8.3.2 Allowed Harvest Impacts under NOAA Biological Opinions

Harvest of ESA-listed fish, including the Mid-Columbia River steelhead ESU, is controlled by NOAA Fisheries to protect weak stocks. The Oregon Fish and Wildlife Commission also sets limits on certain fisheries to protect the listed stocks. Impacts from harvest regulations to protect Mid-Columbia steelhead are discussed below.

Mid-Columbia ESU Winter Steelhead

The NOAA Biological Opinion for 2005 set a mainstem Columbia River non-tribal impact limit on winter steelhead of 6% (including both sport and commercial impacts), and a tribal impact limit of 10.7%. The Oregon Fish and Wildlife Commission set a mainstem non-tribal impact limit on winter steelhead of 2%, which was the guideline that was actually implemented in 2005. A Biological Opinion and impact limit for the 2006 mainstem fishery has not been released; however 2% could reasonably be anticipated. Oregon has FMEPs in place that set tributary impact limits between 0% and 2.5%.

Mid-Columbia ESU Summer Steelhead

The NOAA Biological Opinion for 2005 set a mainstem Columbia River non-tribal impact limit on summer steelhead of 4%, including both sport and commercial impacts. This limit is split across two seasons, with 2% applied to spring and summer fisheries and 2% applied to fall fisheries. A tribal impact limit of 8.2% is set for Zone 6. Oregon has FMEPs in place or proposed that set tributary impact limits between 0% and 5%.

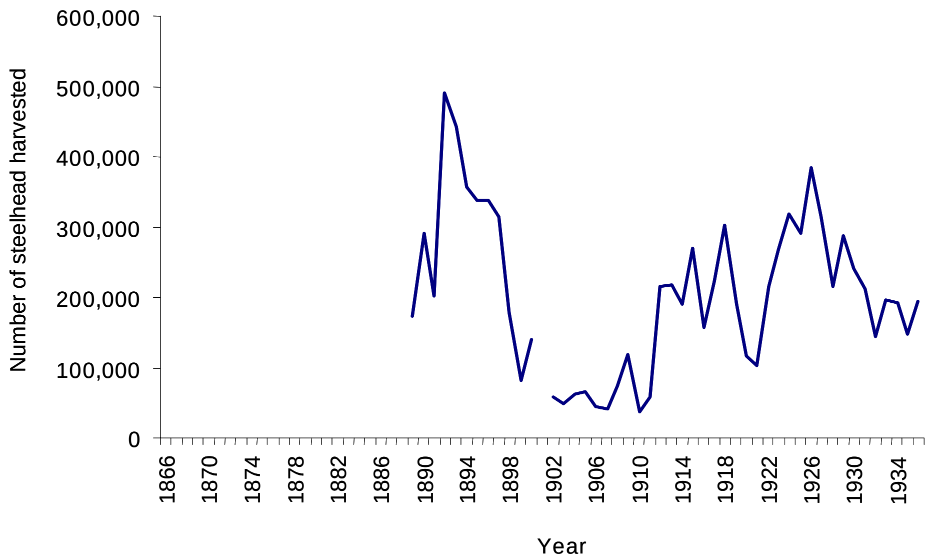


Figure 8-14. Number of steelhead harvested each year in mainstem Columbia River fisheries (1866-1936) (Craig and Hacker 1940).

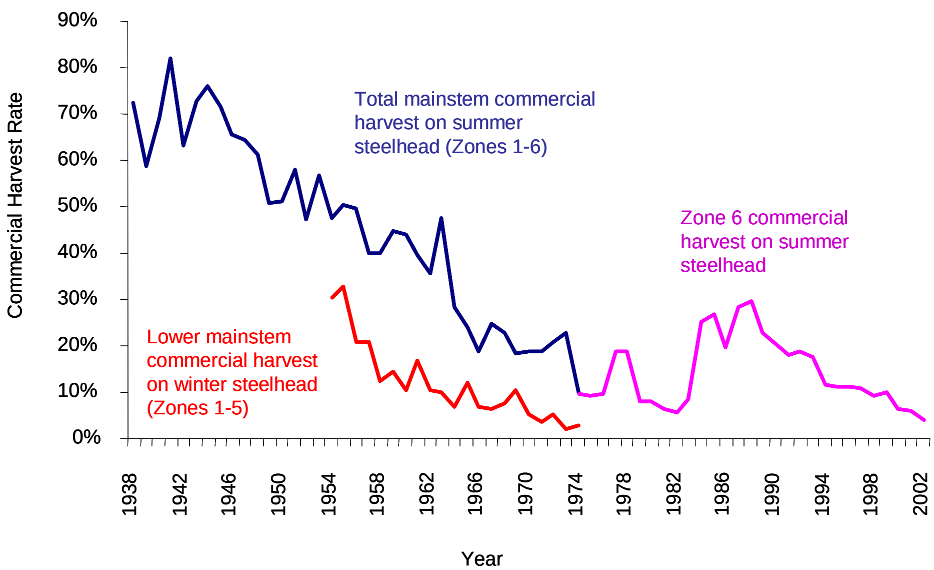


Figure 8-15. Commercial harvest rates on steelhead, 1938 – 2002 (WDFW and ODFW 2002). Non-tribal commercial harvest was discontinued in 1975

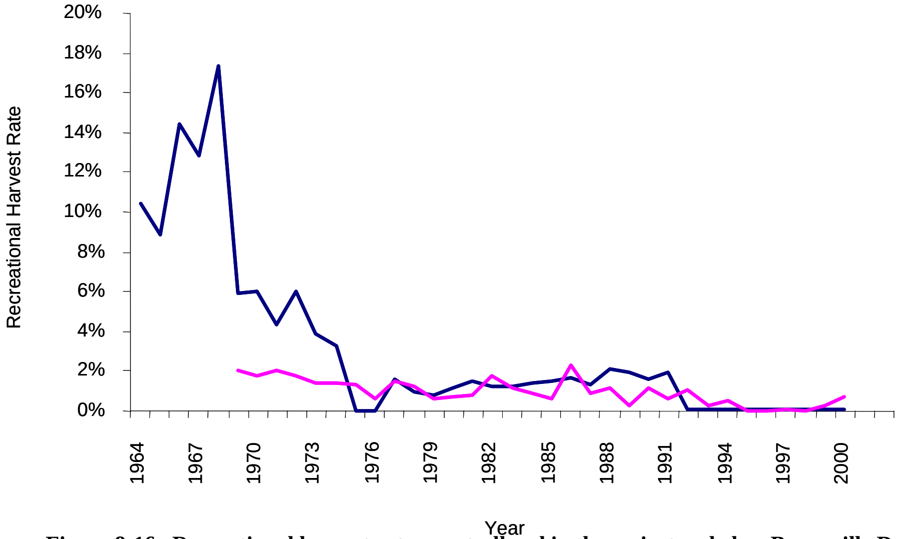


Figure 8-16. Recreational harvest rates on steelhead in the mainstem below Bonneville Dam, 1964 – 2002 (WDFW and ODFW 2002). Blue is summer steelhead while pink is winter steelhead. All mainstem fisheries became catch-and-release in 1992 and the impacts since that year were calculated by the encounter rate and an estimated release mortality

8.3.3 Actual Recent Harvest Impacts

Monitoring of harvest impacts on Mid-Columbia River steelhead is complex because there is no direct non-tribal harvest on wild steelhead from the Mid-Columbia ESU and all catch is indirect. Indirect effects include incidental mortality of fish that are caught and released, encounter fishing gear but are not landed, or are harvested incidentally to the target species or stock. Monitored and unmonitored fisheries, as well as impacts due to fishing gear and environmental conditions are discussed below.

Monitored Fisheries

Actual harvest impacts on Mid-Columbia ESU steelhead over the last several years have been incompletely monitored. Monitoring of incidental harvest impacts is complex for two reasons. First, since all caught fish are released, encounter rates and characteristics of encountered fish are difficult for monitors to observe. Second, released fish experience a mortality rate, possibly delayed and difficult to measure, that is highly variable and depends upon what gear is used, how the fish is caught by the gear, how the fish are handled during capture and release, and on environmental conditions.

Ocean commercial and recreational harvest of salmon has generally declined in recent years because of international treaties, fisheries conservation acts, regional conservation goals, the Endangered Species Act, and state and tribal management agreements. Creels on recreational ocean fisheries recorded less than 100 steelhead caught each year in 2003 – 2005. Of these, less than 10 were estimated to be released wild fish mortalities.

The only effort to regularly monitor steelhead by-catch in non-tribal commercial fisheries occurs in the spring Chinook commercial fishery in the mainstem Columbia below Bonneville Dam, which impacts primarily winter steelhead. This monitoring effort began in 2003 and employs observers on board fishing boats to measure steelhead encounter rates and uses information from recent literature to set a release mortality rate from gill nets according to mesh size. The estimated impact rate on wild winter steelhead from 2003 to 2005 ranged from 0.5% to 1% (Table 8-34). The measurements have an unknown error around these numbers due to the use of point estimates for encounter rates, mortality rates and escapements, all of which actually contain some variance and/or measurement error.

Recreational creels in the lower Columbia mainstem below Bonneville Dam and in the lower Deschutes and Umatilla include questions about wild steelhead releases to estimate encounter rates, and use recent literature to set a hooking mortality rate. Estimated recent impact rates in these recreational fisheries ranged from 0.1% to 1.5% in each fishery. The fish in any particular population may be exposed to several of the fisheries as they move through the mainstem and into tributaries, but the total recreational impact is probably less than 2.5% in most cases. Again, there is an unknown error around these numbers.

Catch of steelhead in the Zone 6 tribal fishery is easier to monitor since steelhead sold to commercial buyers are counted and measured. However, some tribal steelhead catch, and possibly much of it, may not be reported if they are sold over the bank by individuals or if they are retained for personal use. Tribal biologists make some effort to account for unreported catch, especially in fall fisheries. Reported steelhead catch in Zone 6 winter and spring fisheries ranged from 0.7% to 7.9% of the winter steelhead run over Bonneville Dam (Table 8-34). Reported steelhead catch in Zone 6 summer and fall fisheries in 2003 and 2004 was 2.6% and 2.7% of the summer steelhead run over Bonneville Dam (Table 8-35). In 2004, the estimated non-reported catch increased the impact to 4.8% of the run at Bonneville. Again, there is an unknown error around these numbers.

Potential impacts due to harvest selectivity are only taken into account in the Zone 6 tribal fishery. The fishery is thought to select for larger steelhead because of the use of gill nets with unrestricted mesh sizes. Mesh size in these fisheries is generally selected to optimize the catch of Chinook, which is the target species. Smaller and younger steelhead are able to escape many nets. The Zone 6 fishery monitors the catch of large steelhead as a separate stock. The 2004 estimated impact on large verses small fish is presented in Table 8-36. Each of the four “stocks” also has a distinct run timing, which may account for hatchery/wild differences within size category.

Unmonitored Fisheries

All other fisheries that could encounter steelhead have been unmonitored or irregularly monitored in the past few years. All of these other fisheries must release caught steelhead, but mortality can still occur. The Mid-Columbia steelhead ESU is a diverse ESU that includes both winter and summer-run steelhead. Winter steelhead move through the Columbia River between November and May. Summer steelhead move through the Columbia River primarily between April and October, although some may be present at other times. Therefore, steelhead from this ESU are present in the mainstem Columbia River nearly year-round, making them potentially vulnerable to a variety of lower mainstem fisheries (Figure 8-17). Some information about potential impacts caused by these fisheries can be inferred by the season and gear, which determine steelhead vulnerability to the fisheries.

Ocean fisheries generally target chinook and coho salmon, and interception of steelhead is believed to be rare. Currently, however, all ocean commercial fisheries are unmonitored for steelhead by-catch.

Unmonitored mainstem non-tribal commercial fisheries target sturgeon, summer and fall Chinook, sockeye, shad and coho. These fisheries all use gill nets of various sizes and occur between the mouth of the Columbia River and Bonneville Dam, although particular fisheries may target specific zones (Table 8-37). All steelhead taken in commercial nets must be released, but are subjected to encounter rates and release mortalities that vary by gear and season.

The primary fisheries targeting steelhead occur in the Columbia River mainstem and tributaries. These fisheries harvest primarily hatchery fish, and wild fish mortality is incidental. Unmonitored recreational fisheries currently occur in the mainstem Columbia above Bonneville Dam, Fifteenmile Creek (winter steelhead), Deschutes River above Sherars Falls, and in the John Day and Walla Walla rivers.

Encounter Rates and Mesh Size

Encounter rates for Mid-Columbia steelhead increase with smaller mesh nets. Figure 8-18 shows the number of steelhead caught and released per Chinook landed, by mesh size, as observed in the spring Chinook fishery from 2003 to 2005 (test fisheries, research and observer data combined).

Generally, few steelhead are caught in nets that are 9-inch mesh or larger because most fish are able to swim through them, although steelhead catch has been observed to be as high as one steelhead per four Chinook landed, and the steelhead that are caught are the large fish. Some fisheries use 8-inch minimum mesh size, which has a slightly higher encounter of steelhead and is also selective for large fish. Mid-size mesh nets (5 to 6 inches) gill or body-wedge steelhead, and have high encounter rates and a high mortality rates. Small mesh "tangle" nets (4¼-inch) tangle most steelhead, causing high encounter rates but lower mortality rates compared to nets that gill fish. Some fisheries that are designed to catch small species (like shad) use nets with low break poundage that allow larger salmonids to break loose from the nets.

Release Mortality Rates, Mesh Size and Environmental Conditions

Release mortality rates in mainstem commercial fisheries vary by mesh size. The highest mortality rates occur when fish are gilled or body-wedged by the nets. In spring fisheries, when the river is relatively cool, release mortalities from nets that gill fish are 40% or higher.

Steelhead are gilled or wedged in nets that are 5.5 inches are larger, until the mesh is large enough for the fish to swim through them. Nets that tangle fish, (4¼-inch for steelhead) have mortalities near 20% during the cool spring fisheries. Some fishing practices, particularly long soak times, increase mortality rates. Mortality rates increase dramatically during warm water conditions that occur in the summer and fall.

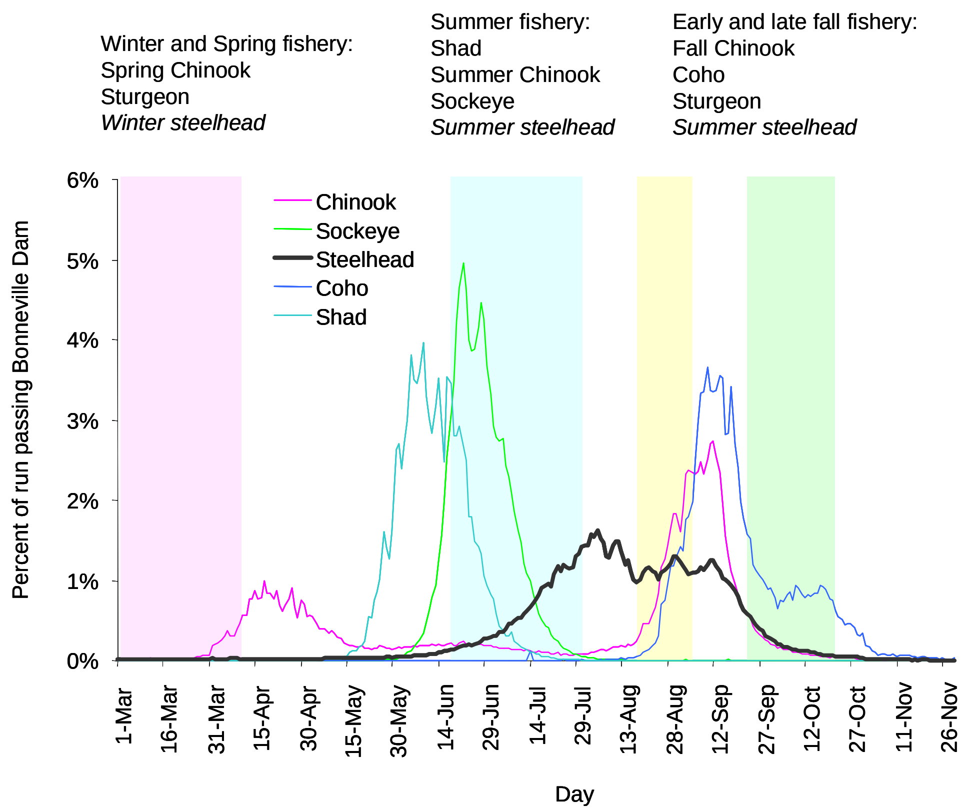


Figure 8-17. Run timing at Bonneville Dam of steelhead and other species that are targeted in mainstem commercial fisheries.

Table 8-34. Estimated impacts on winter steelhead in winter and spring mainstem fisheries (2003 – 2005).

	Non-tribal Commercial		Tribal	
Year	Number of wild steelhead	Impact rate (of Columbia River mouth escapement)	Total number of steelhead (wild + hatchery)	Impact rate (of Bonneville Dam escapement)
2003	229	1.0%	807	7.9%
2004	238	0.8%	81	0.7%
2005	69	0.5%	208	3.6%

Table 8-35. Estimated impacts on summer steelhead in summer and fall Zone 6 fisheries. Fish numbers include hatchery and wild steelhead, and impact rates are calculated based on the Bonneville Dam escapement.

Year		Summer		Fall						Total summer/fall	
				Bonneville Pool		The Dalles Pool		John Day Pool			
		Fish	Impact rate	Fish	Impact rate	Fish	Impact rate	Fish	Impact rate	Fish	Impact rate
2003	Ticketed	96	<0.1%	4,484	1.3%	2,478	0.7%	2,251	0.6%	9,309	2.6%
2004	Ticketed	714	0.2%	4,611	1.5%	1,792	0.6%	1,219	0.4%	8,336	2.7%
	Est. Total Landed in 2004 (Ticketed, non-ticketed, and C&S)									14,757	4.8%

Table 8-36. Estimated selectivity of the 2004 Zone 6 fishery. The size breakout is that "Small" fish are less than 78 cm, while "Large" fish are equal to or greater than 78 cm. Estimated impact rates are based on the abundance of each group at Bonneville Dam.

Characteristic	Number of Fish	Estimated Impact Rate
Small hatchery	6,791	3.2%
Small wild	1,963	3.4%
Large hatchery	4,963	17.2%
Large wild	1,040	10.6%

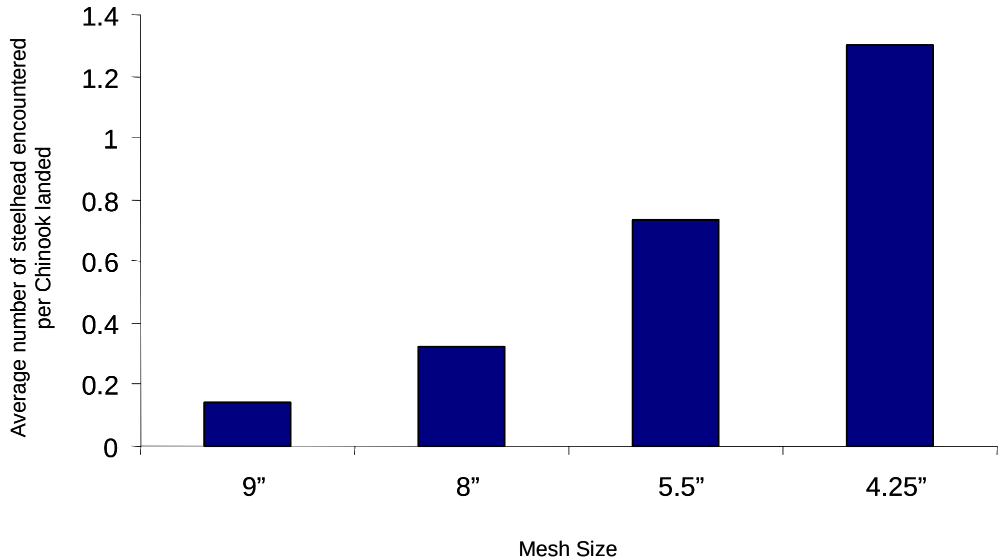


Figure 8-18. Number of steelhead released per number of Chinook landed by mesh size, as observed during monitoring and test fishing in 2003 – 2005 spring Chinook fisheries.

Table 8-37. Characteristics of commercial fisheries in the Columbia River below Bonneville Dam.

Fishery	Non-tribal Season	Non-tribal Gear	Tribal Season	Tribal Gear	Water temperature	Steelhead life history present
Sturgeon	variable	9 inch min.	variable	Dip nets, set lines and gill nets with no mesh size restrictions	variable	winter and summer
Spring Chinook	Late Feb. to early April	9 inch min. or 4 ¼ inch max.	February through April		low	winter steelhead
Shad	May and June	5 $^{3}/_{8}$ to 6 ¼ inch 10 lb break	no specific fishery		high	Summer steelhead
Sockeye	June and July	4 ¼ inch max.	June and July		high	Summer steelhead
Summer Chinook	June and July	8 inch min.	June and July		high	Summer steelhead
Fall Chinook	August, late Sept.	8 inch min. or 9 inch min.	August through October		high	Summer steelhead
Coho	Late Sept. and October	No min. 5 - 6 inch nets used	September and October		high	Summer steelhead

8.4 Hatchery-Related Limiting Factors

This section describes potential hatchery-related limit factors for Mid-Columbia steelhead populations in the Deschutes, John Day, Umatilla and Walla Walla river systems.

8.4.1. Deschutes River Steelhead

Hatchery steelhead are produced at Round Butte Hatchery to mitigate for the loss of habitat and harvest opportunities due to the construction and operation of the Round Butte Complex of hydroelectric dams. The goal of the program is to produce 1,800 adults returning to the project. Broodstock consists of known origin Round Butte Hatchery stock. Wild-origin fish were incorporated into the broodstock during the 1990 – 1998 brood years, but the practice was discontinued due to concerns about introducing or propagating diseases borne by unmarked fish of unknown origin from outside the basin.

As mitigation programs developed in other Columbia Basin watersheds, the number of out-of-basin hatchery origin steelhead observed in the Deschutes River began to increase (Figure 8-19 and Table 8-38). A majority of these fish were produced in the Snake River Basin under the Lower Snake River Compensation Program. Noteworthy is the relatively large proportion of out-of-basin steelhead originating from the Wallowa Hatchery program (Olson and Spateholz undated).

The most comprehensive records of stock composition to suggest the rate at which hatchery-origin steelhead might spawn in the wild are from trap observations at Warm Springs NFH. There, all steelhead known to be artificially produced are removed from the natural-origin population that is allowed to pass upstream. At Warm Springs NFH, Round Butte Hatchery steelhead make up a small proportion of the fish intercepted at the trap (Table 8-39). The majority originate from LSRCP mitigation programs (Olson and Spateholz undated). For assessments of the number of hatchery-origin fish spawning with natural origin fish, we assumed that the rate at which Round Butte Hatchery and out-of-ESU hatchery steelhead appear at Warm Springs NFH represents the potential rate at which hatchery-origin fish maybe spawning naturally in Shitike and Trout creeks.

Hatchery-origin steelhead have been observed spawning with unfin-clipped steelhead in Deschutes River tributaries and both live and dead hatchery-origin steelhead are observed during spawning ground surveys in Bakeoven and Buck Hollow creeks (Table 8-40). However, the fish are not handled and stock composition of hatchery-origin steelhead is unknown. Stock composition of hatchery-origin fish that ascend Sherars Falls (the trapping facility most proximate to Bakeoven and Buck Hollow creeks) is monitored in terms of the proportion of Round Butte Hatchery steelhead relative to hatchery fish that originate from outside the basin, but the rate at which out-of-basin fish that ascend the falls remain within the Deschutes and spawn among the native populations is not well known. For the purposes of assessing potential hatchery effects in Bakeoven and Buck Hollow creeks, we noted that the trend in abundance of hatchery-origin fish within each tributary appeared to follow that at Sherars Falls but at an overall lower rate. We believe that a majority of hatchery fish observed on the spawning grounds are from outside the Deschutes River Basin.

Measures to Reduce Adverse Hatchery-Wild Interactions

Broodstock is collected only from the Round Butte Hatchery Stock to maintain its genetic integrity and wild fish are not incorporated into the broodstock to prevent the propagation of out-of-basin diseases. All hatchery fish not used for broodstock and all out-of-basin hatchery fish are removed from the river at Pelton Trap and Warm Springs NFH. Juveniles are released as age 1+ smolts, and while competitive interactions could occur among wild juvenile steelhead at various ages, if smolts actively migrate downstream, the duration of potential negative interactions would be relatively short. Interactions in overwintering or rearing habitat could be expected to be low. It should be noted that resident *O. Mykiss* naturally exist at multiple ages and at relatively great densities in portions of the mainstem of the Deschutes River and co-exist with other native salmonids including wild steelhead.

The potential exists to more comprehensively monitor the presence of hatchery fish in the wild, and to possibly remove them from the natural population in Shitike and Trout creeks. The Shitike Creek Trap is not specifically fished to monitor steelhead, rather is used for investigations on reproductive success of hatchery-origin spring Chinook salmon and evaluation of bull trout life histories (personal communication, D. Hand, CRFP, USFWS). The Trout Creek trap was first operated in 2005. Both traps are not fished continuously and are less efficient than the Warm Springs NFH barrier.

Potential Inter-Specific Interactions

Two spring Chinook salmon hatchery programs exist in the Deschutes River Subbasin, one at Warm Springs NFH and one at Round Butte Hatchery. The programs exist to mitigate for lost habitat and harvest opportunities due to construction and operation of the Round Butte Complex of hydroelectric dams. Spring Chinook salmon occur naturally in the Warm Springs River and Shitike Creek. Spring Chinook salmon are reared as juveniles to age 1+ smolts, and as noted above if smolts actively migrate downstream after release, the duration of time that negative interactions could occur with native steelhead juveniles would be relatively short. Interactions in overwintering and other rearing habitat would be minimal. Bacterial Kidney Disease occurs within the Round Butte Hatchery broodstock.

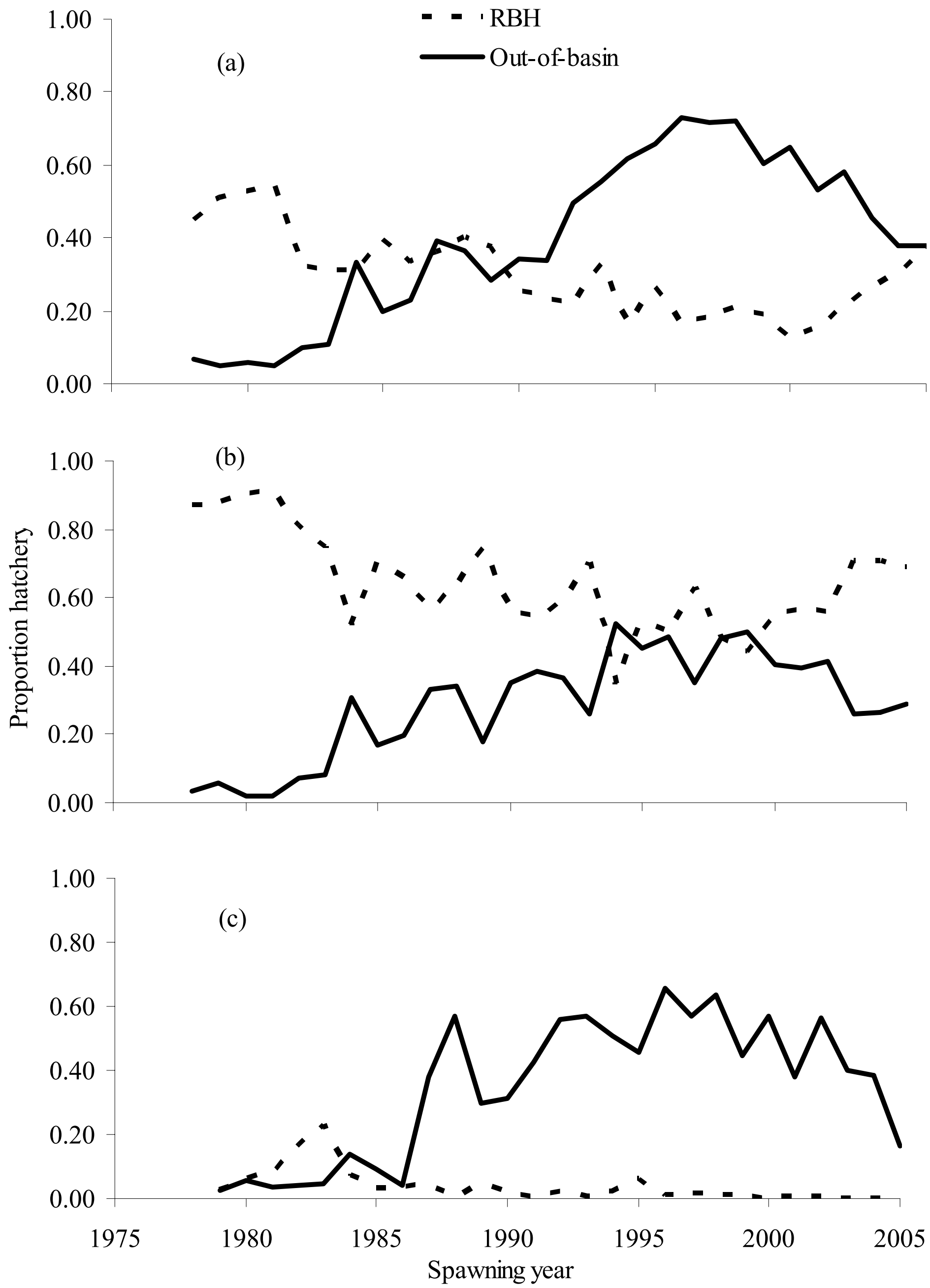


Figure 8-19. Proportion of steelhead that are Round Butte Hatchery and out-of-basin hatchery origin by trapping facility. (a) Sherars Falls (b) Pelton Trap (c) Warm Springs NFH.

Table 8-38. Number of steelhead by origin in the Deschutes River by year and trapping facility, 1977 - 2004.

		Estimated Escapement of Steelhead at Sherars Falls				*Steelhead at Pelton Trap*				*Steelhead at Warm Springs NFH*			
Return year	Brood year	Wild	Round Butte Hatchery	Out-of-basin hatchery	Total	Wild	Round Butte Hatchery	Out-of-basin hatchery	Total	Wild	Round Butte Hatchery	Out-of-basin hatchery	Total
1977	1978	6,556	6,121	900	13,577	233	2,120	80	2,433	336			336
1978	1979	2,759	3,184	300	6,243	136	1,732	110	1,978	290	8	8	306
1979	1980	4,204	5,400	600	10,204	223	2,612	54	2,889	311	22	20	353
1980	1981	4,100	5,500	500	10,100	169	2,195	47	2,411	397	36	15	448
1981	1982	6,900	3,800	1,200	11,900	245	1,760	156	2,161	569	122	31	722
1982	1983	6,567	3,524	1,249	11,340	344	1,547	167	2,058	255	82	16	353
1983	1984	8,228	7,250	7,684	23,162	814	2,439	1,452	4,705	431	40	75	546
1984	1985	7,721	7,563	3,824	19,108	603	3,278	795	4,676	577	22	62	661
1985	1986	9,624	7,382	5,056	22,062	686	3,153	943	4,782	373	15	16	404
1986	1987	6,207	9,064	9,803	25,074	467	2,640	1,538	4,645	822	60	545	1,427
1987	1988	5,367	9,209	8,367	22,943	46	1,484	796	2,326	522	4	695	1,221
1988	1989	3,546	3,849	2,909	10,304	123	1,247	300	1,670	385	28	177	590
1989	1990	4,278	2,758	3,659	10,695	136	829	524	1,489	339	10	157	506
1990	1991	3,653	1,990	2,852	8,495	82	606	428	1,116	165	2	123	290
1991	1992	4,826	3,778	8,409	17,013	101	1,365	849	2,315	280	14	374	668
1992	1993	904	2,539	4,261	7,704	59	1,157	427	1,643	82	1	109	192
1993	1994	1,487	1,159	4,293	6,939	74	190	288	552	135	6	146	287
1994	1995	482	1,781	4,391	6,654	27	753	642	1,422	93	12	88	193
1995	1996	1,662	2,708	11,855	16,225	32	1,000	976	2,008	87	3	171	261
1996	1997	3,458	5,932	23,618	33,008	126	3,605	2,001	5,732	239	8	327	574
1997	1998	1,820	5,042	17,703	24,565	194	2,440	2,459	5,093	218	6	388	612
1998	1999	3,800	3,527	11,110	18,437	155	1,135	1,284	2,574	97	2	79	178
1999	2000	4,790	2,628	13,785	21,203	83	1,050	768	1,901	322	0	422	744
2000	2001	8,985	4,380	15,072	28,437	114	1,593	1,103	2,810	513	3	316	832
2001	2002	8,749	9,373	25,263	43,385	282	4,942	3,674	8,898	733	12	971	1,716
2002	2003	9,363	8,880	15,203	33,446	207	4,841	1,787	6,835	877	0	582	1,459
2003	2004	5,524	5,265	6,542	17,331	104	2,605	967	3,676	286	0	178	464
2004	2005	3,161	4,942	4,949	13,052	79	2,143	903	3,125	327	1	64	392

Table 8-39. Proportions of steelhead by origin in the Deschutes River by year and trapping facility, 1977 - 2004.

		Estimated Escapement at Sherars			*Pelton Trap*			*Warm Springs NFH*		
Return year	Spawning year	Wild	RBH	Out-of-basin	Wild	RBH	Out-of-basin	Wild	RBH	Out-of-basin
1977	1978	0.48	0.45	0.07	0.10	0.87	0.03			
1978	1979	0.44	0.51	0.05	0.07	0.88	0.06	0.95	0.03	0.03
1979	1980	0.41	0.53	0.06	0.08	0.90	0.02	0.88	0.06	0.06
1980	1981	0.41	0.54	0.05	0.07	0.91	0.02	0.89	0.08	0.03
1981	1982	0.58	0.32	0.10	0.11	0.81	0.07	0.79	0.17	0.04
1982	1983	0.58	0.31	0.11	0.17	0.75	0.08	0.72	0.23	0.05
1983	1984	0.36	0.31	0.33	0.17	0.52	0.31	0.79	0.07	0.14
1984	1985	0.40	0.40	0.20	0.13	0.70	0.17	0.87	0.03	0.09
1985	1986	0.44	0.33	0.23	0.14	0.66	0.20	0.92	0.04	0.04
1986	1987	0.25	0.36	0.39	0.10	0.57	0.33	0.58	0.04	0.38
1987	1988	0.23	0.40	0.36	0.02	0.64	0.34	0.43	0.00	0.57
1988	1989	0.34	0.37	0.28	0.07	0.75	0.18	0.65	0.05	0.30
1989	1990	0.40	0.26	0.34	0.09	0.56	0.35	0.67	0.02	0.31
1990	1991	0.43	0.23	0.34	0.07	0.54	0.38	0.57	0.01	0.42
1991	1992	0.28	0.22	0.49	0.04	0.59	0.37	0.42	0.02	0.56
1992	1993	0.12	0.33	0.55	0.04	0.70	0.26	0.43	0.01	0.57
1993	1994	0.21	0.17	0.62	0.13	0.34	0.52	0.47	0.02	0.51
1994	1995	0.07	0.27	0.66	0.02	0.53	0.45	0.48	0.06	0.46
1995	1996	0.10	0.17	0.73	0.02	0.50	0.49	0.33	0.01	0.66
1996	1997	0.10	0.18	0.72	0.02	0.63	0.35	0.42	0.01	0.57
1997	1998	0.07	0.21	0.72	0.04	0.48	0.48	0.36	0.01	0.63
1998	1999	0.21	0.19	0.60	0.06	0.44	0.50	0.54	0.01	0.44
1999	2000	0.23	0.12	0.65	0.04	0.55	0.40	0.43	0.00	0.57
2000	2001	0.32	0.15	0.53	0.04	0.57	0.39	0.62	0.00	0.38
2001	2002	0.20	0.22	0.58	0.03	0.56	0.41	0.43	0.01	0.57
2002	2003	0.28	0.27	0.45	0.03	0.71	0.26	0.60	0.00	0.40
2003	2004	0.32	0.30	0.38	0.03	0.71	0.26	0.62	0.00	0.38
2004	2005	0.24	0.38	0.38	0.03	0.69	0.29	0.83	0.00	0.16
	Minimum	0.07	0.12	0.05	0.02	0.34	0.02	0.33	0.00	0.03
	Maximum	0.58	0.54	0.73	0.17	0.91	0.52	0.95	0.23	0.66
	Average	0.30	0.30	0.39	0.07	0.64	0.29	0.62	0.04	0.34

Table 8-40. Proportion of hatchery fish by location in the lower Deschutes Subbasin (for N > 9).

		Buck Hollow			Bakeoven			Trout Creek		
Return year	Spawning year	Marked	Unmarked	Hatchery fraction	Marked	Unmarked	Hatchery fraction	Marked	Unmarked	Hatchery fraction
1989	1990	2	14	0.125	1	2	N/A	--	--	--
1990	1991	2	4	N/A	0	5	N/A	--	--	--
1991	1992	1	9	0.100	0	0	N/A	--	--	--
1992	1993	2	1	N/A	3	2	N/A	--	--	--
1993	1994	1	1	N/A	0	0	N/A	--	--	--
1994	1995	11	11	0.500	3	1	N/A	--	--	--
1995	1996	11	7	0.611	8	2	0.800	--	--	--
1996	1997	23	9	0.719	9	4	0.692	--	--	--
1997	1998	26	1	0.963	2	3	N/A			0.250
1998	1999	14	15	0.483	6	13	0.316			0.390
1999	2000	8	8	0.500	17	14	0.548			0.500
2000	2001	23	108	0.176	29	167	0.148	--	--	--
2001	2002	20	42	0.323	10	55	0.154	--	--	--
2002	2003	17	43	0.283	4	19	0.174	9	48	0.158
2003	2004	33	30	0.524	5	8	0.385	0	8	0.000
2004	2005	2	12	0.143	0	4	N/A	1	85	0.012
	Average			0.419			0.402			0.218

8.4.2. John Day River Steelhead

John Day River steelhead are currently managed entirely as an wild populations. No hatchery production or supplementation occurs within the John Day River Basin.

Program History

The John Day River has historically been managed for wild summer steelhead (ODFW 1990). No records exist regarding the intended purpose for releases of hatchery steelhead prior to 1966. Hatchery steelhead released between 1966 and 1969 were for experimental use only and were not meant for production purposes (ODFW 1990, Olsen et al 1994). Unfortunately, no records or documentation are available regarding the outcome of the claimed experiments.

Hatchery releases of summer and winter run steelhead have occurred historically in the John Day River basin between 1925 and 1969 (Table 8-41). Rainbow trout make up the majority of all hatchery fish species released into the John Day basin (Table 8-42). The mean annual stocking rate of hatchery *O. mykiss* in the John Day basin between 1925 and 1997 was 71,402 fish and ranged between 5,000 and 612,668 fish. Concern over competition for resources with wild stocks and potential hybridization with wild stocks ended all hatchery stocking of *O. mykiss* in rivers and streams of the John Day River basin in 1997. Stocking of steelhead ended in the John Day River basin in 1969.

Table 8-41. Year, run (W-winter, S-summer, U-unknown), number, tributary, and subbasin of release for all known hatchery steelhead released into the John Day River Basin from 1925 - 1969.

Year	Run	Number	Tributary	Subbasin
1925	U	16,080	Canyon Creek	Upper Mainstem
1941	U	8,760	Canyon Creek	Upper Mainstem
1947	U	7,600	Rock Creek	Lower Mainstem
1947	U	7,520	Thirtymile Creek	Lower Mainstem
1962	W	200,000	Camas Creek	North Fork
1962	W	375,000	Granite Creek	North Fork
1963	U	10,667	Mainstem	Mainstem
1964	W	10,198	Upper Mainstem	Upper Mainstem
1965	W	27,860	South Fork	South Fork
1966	S	55,518	Middle Fork	Middle Fork
1967	S	98,090	Upper Mainstem	Upper Mainstem
1967	S	71,500	Camas Creek	North Fork
1969	S	22,375	Bridge Creek	Middle Fork

Table 8-42. Summary of all known stocking records for hatchery salmonids released into the John Day River Basin from 1925-1997. Species include rainbow trout (RbT), steelhead of unknown run (Sthd), winter steelhead (StW), summer steelhead (StS), brook trout (BkT), and west slope cutthroat trout (WcT).

Year	RbT	Sthd	StW	StS	Coho	BkT	WcT	Total releases
1925	77,000	16,080			25,000			118,080
1926	25,680				45,000	42,745		113,425
1927	6,000							6,000
1928	43,000				27,530			70,530
1929	29,3000							293,000
1930					50,000			50,000
1931	5,000				10,000			15,000
1932								0
1933	70,000				8,050			78,050
1934	31,000							31,000
1935								0
1936								0
1937								0
1938								0
1939								0
1940	92,206				50,268			142,474
1941	66,930	8,760						75,690
1942	36,632							36,632
1943	16,763							16,763
1944	31,050							31,050
1945	16,080							16,080
1946	36,960							36,960
1947	254,025	15,120						269,145
1948	66,025							66,025
1949	10,290							10,290
1950	52,343							52,343
1951	14,560							14,560
1952	21,808							21,808
1953	24,376							24,376
1954	36,946							36,946
1955	58,783							58,783
1956	57,297							57,297
1957	43,206							43,206
1958	71,272							71,272
1959	41,727							41,727
1960	41,498							41,498
1961	29,980							29,980
1962	37,668		57,5000					612,668
1963	38,931	10,667						49,598
1964	17,508		10,200					27,708
1965	72,598		27,860				199	100,657
1966	17,4305			55,518		325,793	59,425	615,041
1967	141,210			170,500				311,710
1968	24,493							24,493
1969	325,185			22,375				347,560
1970	184,227							184,227

Table 8-42 continued. Summary of all known stocking records for hatchery salmonids released into the John Day River Basin from 1925-1997. Species include rainbow trout (RbT), steelhead of unknown run (Sthd), winter steelhead (StW), summer steelhead (StS), brook trout (BkT), and west slope cutthroat trout (WcT).

Year	RbT	Sthd	StW	StS	Coho	BkT	WcT	Total releases
1971	31,547							31,547
1972	60,093							60,093
1973	141,758							141,758
1974	84,809							84,809
1975	87,850							87,850
1976	84,121							84,121
1977	85,173							85,173
1978	110,521							110,521
1979	148,294							148,294
1980	95,565							95,565
1981	87,480							87,480
1982	106,053							106,053
1983	111,964							111,964
1984	46,567							46,567
1985	57,715							57,715
1986	64,226							64,226
1987	8,997							8,997
1988	43,572							43,572
1989	29,369							29,369
1990	32,987							32,987
1991	21,036							21,036
1992	21,043							21,043
1993	8,004							8,004
1994	22,525							22,525
1995	7,993							7,993
1996	6,988							6,988
1997	6,479							6,479

Run Composition

Hatchery steelhead coded wire tag (CWT) recoveries in the basin from 1986 to 2003 (378 recoveries) identify 18 separate hatcheries as the source of strays. The majority of CWT recoveries were located downstream of Tumwater Falls in the John Day Arm (316 recoveries) and may not represent fish that strayed and spawned within the John Day River basin. Data indicates Dworshak National Hatchery as the predominate source of hatchery steelhead strays in this portion of the basin (97 CWT recoveries; 31%). Between Tumwater Falls and Cottonwood Bridge (rm 40) fifty-five hatchery CWT recoveries have been reported with many recoveries (26 CWT recoveries; 47%) in this area identifying Irrigon Hatchery (fish released in the Grande Ronde or Imnaha River basins) as the source of strays. Limited information is available upstream of Cottonwood Bridge with only seven hatchery CWT recoveries reported. Irrigon hatchery was the source of two hatchery steelhead strays in this area. It should be noted that the prevalence of strays in the John Day River from any particular hatchery stock is dependent on both the stray rate of that stock and the number of individuals tagged from the stock. Different hatchery stocks are not tagged at the same rate.

Table 8-43. Hatchery source, stock, number recovered, recovery period, and release agency for hatchery steelhead with coded wire tags in the John Day River ABV ARM (Tumwater Falls upstream to Cottonwood Bridge) from 1996-2003. Data were compiled from the Pacific States Marine Fishery Commission Regional Mark Information System.

Hatchery Source	Stock	Number Recovered	Recovery Period	Release Agency
Irrigon	Wallowa R., Imnaha R. & tributaries	25	10/10 - 05/07	ODFW
Cottonwood Creek Pond	Wallowa R.	10	10/11 - 05/23	WDFW
Magic Valley	Pahsimeroi R. 'A' run, Dworshak 'B' run, East Fork Salmon R. 'B' run	5	10/27 - 01/31	IDFG
Niagara Springs	Pahsimeroi R. 'A' run, Hells Canyon ‘A’ run	5	10/20 - 01/24	IDFG
Clearwater	Dworshak 'B' run	2	01/09 - 02/10	IDFG
Dworshak National	Dworshak 'B' run	2	10/17 - 02/09	FWS
Umatilla	Umatilla R.	2	10/09 - 11/11	ODFW

Table 8-44. Hatchery source, release location, recovery location, number recovered, and recovery year for hatchery steelhead with coded wire tags in the John Day River above Cottonwood Bridge (rkm 64) from 1988-2003. Data were compiled from archives in the John Day Field Office and Wilson et al. (2004).

Hatchery Source	Release Location	Recovery Location	Number Recovered	Recovery Year
Big Canyon	Unknown	Lower North Fork	1	1994
Irrigon	Spring Creek of Wallowa R., OR	Kahler Creek, Lower Mainstem	1	2003
Irrigon	Big Canyon Creek of Wallowa R., OR	Service Creek, Lower Mainstem	1	2003
Cottonwood Creek Pond	Grande Ronde R., OR	Service Creek, Lower Mainstem	1	2003
Unknown Washington Hatchery	Unknown	Service Creek, Lower Mainstem	1	2003
Upper Columbia	Unknown	Cottonwood Bridge to Little Ferry Canyon	1	1988
Wallowa	Unknown	Lower North Fork	1	1992

Table 8-45. Hatchery source, recovery year, number recovered, and recovery location of hatchery steelhead with coded wire tags in the John Day River Basin. Data were compiled from archives in the John Day Field Office.

Hatchery Source	Recovery Year	Number Recovered	Recovery Location
Rounde Butte	1986	1	Tumwater Falls to Cottonwood Bridge
Irrigon	1996	1	Tumwater Falls to Cottonwood Bridge
Hells Canyon	1996	1	Tumwater Falls to Cottonwood Bridge
Little Sheep	1996	1	Tumwater Falls to Cottonwood Bridge
Upper Columbia	1988	1	Cottonwood Bridge to Little Ferry Canyon
Wallowa	1992	1	Lower North Fork
Big Canyon	1994	1	Lower North Fork

Broodstock Source, Collection and Spawning

No hatchery releases of steelhead have occurred in the John Day River since 1969. There is no broodstock collection in the basin.

Distribution of Hatchery and Natural Adults

Most observations of hatchery adults in the John Day have occurred in the Lower Mainstem, below the confluence with the North Fork (Wiley et al. 2004). However, several reports have noted observations of fin-clipped fish in the North Fork and South Fork drainages. These observations come from both spawning ground surveys and creel programs.

Claire and Gray (1992a) reported 17 (23%) adipose fin clipped steelhead of 75 caught upstream of Kimberly (rkm 296) during the 1992 steelhead fishery. Within the 1992 Zone 3 summer steelhead fishery (Kimberly to Indian Creek), 16% (6 of 37) of the fish reported by anglers were of hatchery origin (Claire and Gray 1992a). Within the 1992 lower North Fork summer steelhead fishery, 29% (11 of 37 reported) of steelhead reported by anglers were of hatchery origin. Claire and Gray (1992a) did not provide an explanation for the high stray rates observed during the 1992 fishery. Wilson et al. (2001) reported observing thirteen adipose fin-clipped adult summer steelhead (46%, both live and as carcasses) of twenty-eight steelhead observed while seining for smolts in the Mainstem John Day River between Kimberly (rkm 298) and Spray (rkm 274).

Wiley et al. (2004) observed 50, live adult steelhead and sampled five carcasses on spawner surveys conducted during 2004. Of the ten sites where live fish were observed they were able to identify 34 fish as hatchery or wild at six of those sites based upon the presence (hatchery) or absence (wild) of an adipose fin clip (fin mark). Hatchery steelhead (13 fish) comprised 38% of live fish observations and were found at two of the six sites where identifications could be made. The majority of live hatchery steelhead observed (12 fish; 92%) and hatchery carcasses sampled (3 fish; 100%) during spawner surveys came from one stream (Service Creek) located in the Lower Mainstem at rkm 245. An additional live hatchery steelhead was also observed in the Lower Mainstem in Rock Creek. They estimated 3,726 wild and 2,284 hatchery steelhead were present during the spawning season based upon the wild:hatchery ratio of live fish observed during spawner surveys.

Similarity Between Hatchery-Origin and Natural-Origin Fish

Wiley et al. (2004) have observed fin-clipped adults paired with wild adults on redds during 2004. Others have also observed hatchery origin fish paired with wild fish during spawning (Wilson et al. 2004).

Smolt releases and acclimation sites

No hatchery releases of steelhead have occurred in the John Day River since 1969.

Juvenile migration timing

Natural and hatchery steelhead show similar trends in outmigration timing,

Residualism

No hatchery releases of steelhead have occurred in the John Day River since 1969.

Other fish releases in the John Day Subbasin

Besides summer steelhead, hatchery salmonid species released into the John Day River Basin included coho salmon, brook trout, and west slope cutthroat trout (Table 8-42). Data regarding the stocking of lakes and ponds is not included.

Program Performance

No hatchery releases of steelhead have occurred in the John Day River since 1969.

Potential Limiting Factors Influencing Viability

Historically, the John Day River basin has been managed exclusively for wild steelhead and low hatchery fractions have been reported (4% - 8%; ODFW 1990). In recent years, however, with additional observations, data indicates that there may be a stronger hatchery influence in the basin than once reported. Observations of pairings between hatchery and wild fish on spawning grounds indicates introgression. No evidence is available for any negative impacts resulting from interactions between hatchery and natural steelhead in the John Day River Basin.

8.4.3. Umatilla River Steelhead

The Umatilla River summer steelhead program was designed to enhance the natural production through supplementation and to provide sustainable harvest in the Umatilla River basin. The annual production goal is for a release of 150,000 smolts. Smolts are adipose fin-clipped to allow for selective fisheries and to monitor returns to TMFD. This program is funded by BPA through the NPCC Fish and Wildlife Program.

Hatchery Program History

The first attempt to supplement the natural population of summer steelhead in the Umatilla River and tributaries was in 1967 when hatchery-produced, non-endemic steelhead from Skamania and Idaho (Oxbow) stocks were released in the Umatilla River (ODFW 1987). From 1968 through 1970, only non-endemic Skamania stock steelhead were released into the Umatilla River. No hatchery-produced steelhead were released in the Umatilla River from 1971 through 1974. The early release numbers and size-at-release varied considerably (Table 8-46). The first release of smolts from endemic Umatilla stock occurred in 1975. There were no releases of hatchery-produced steelhead from 1976 through 1980. Annual releases of smolts from endemic Umatilla stock ensued from 1981 to the present.

Run Composition

Steelhead returns to Three Mile Falls Dam (TMFD) have averaged 956 hatchery, and 1,668 natural fish from the 1992-93 through 2003-04 run years (Table 8-47). Over the same time period, Umatilla hatchery steelhead comprised 23.9-52.0% of the run (mean 32.0%), while out-of-basin hatchery steelhead comprised 2.1-10.1% of the run (mean 3.1%; Table 8-47). Some steelhead are removed at TMFD for broodstock while others are harvested upstream in tribal and non-tribal recreational fisheries. Umatilla hatchery steelhead have comprised 19.0-57.1% of steelhead available to spawn in nature (mean 29.4%), and out-of-basin hatchery steelhead have comprised 1.8-9.7% of potential spawners (mean 4.8%; Table 8-48).

Broodstock Source, Collection, and Spawning

Broodstock are currently collected from returns to the TMFD trap on the Umatilla River (RM 3.7). The broodstock goal is 120 adults, including 10 pairs of coded-wire tagged program fish. Steelhead are transferred to the Minthorn acclimation site for holding and spawning. The coded-wire tags are read prior to spawning to insure out-of-basin hatchery fish are not used for broodstock. Spawning is performed using a 3x3 matrix, selecting for wild x wild crosses whenever possible, and no hatchery x hatchery crosses are used.

Table 8-46. Releases of summer steelhead in the Umatilla River Basin prior to the current program at Umatilla Fish Hatchery (Chess et al. 2003a).

Release Year	Hatchery	No. Released	Fish/lb.	Strategy	Stock	Acclimation Facility	Direct-release
1967	Gnat Creek	109,805	75	Subyearling	Skamania		
1967	Oak Springs	238,020	117	Subyearling	Oxbow		
1967	Wallowa	142,240	240	Subyearling	Oxbow		
1968	Gnat Creek	23,100	66	Subyearling	Skamania		
1968	Gnat Creek	150,000	Eggs	eggs	Skamania		
1969	Oak Springs	174,341	145	Subyearling	Skamania		
1970	Carson	39,489	8.0-9.0	Yearling	Skamania		
1975	Wizard Falls	11,094	9	Yearling	Umatilla		
1981	Oak Springs	17,558	6.0-9.0	Yearling	Umatilla		Upper Umat. R.
1981	Oak Springs	9,400	145	Subyearling	Umatilla		Upper Umat. R.
1982	Oak Springs	59,494	7.0-8.0	Yearling	Umatilla		Upper Umat. R.
1982	Oak Springs	67,940	124	Subyearling	Umatilla		Upper Umat. R.
1983	Oak Springs	60,500	11	Yearling	Umatilla		Upper Umat. R.
1983	Oak Springs	52,700	62	Subyearling	Umatilla		Upper Umat. R.
1984	Oak Springs	57,939	6.5	Yearling	Umatilla		Upper Umat. R.
1984	Oak Springs	22,000	135	Subyearling	Umatilla		Upper Umat. R.
1985	Oak Springs	53,850	7	Yearling	Umatilla		Upper Umat. R.
1985	Oak Springs	39,134	150	Subyearling	Umatilla		Upper Umat. R.
1986	Oak Springs	54,137	8.4	Yearling	Umatilla	Bonifer Spr.	
1987	Oak Springs	1,485	5.5	Yearling	Umatilla		
1988	Oak Springs	30,549	7.4	Yearling	Umatilla	Minthorn Spr.	
1988	Oak Springs	30,757	6.5	Yearling	Umatilla		Umat. R. Minthorn
1988	Oak Springs	33,984	10.3	Yearling	Umatilla		Umat. R. Stanfield
1988	Oak Springs	10,033	57.5	Subyearling	Umatilla		Umat. R. Corporation
1988	Irrigon	24,618	3,200	unfed fry	Umatilla		S. Fk. Umatilla R.
1989	Oak Springs	29,852	6.6	Yearling	Umatilla	Minthorn Spr.	
1989	Oak Springs	29,586	5.6	Yearling	Umatilla		Umat. R. at Minthorn
1990	Oak Springs	30,225	5.9	Yearling	Umatilla	Bonifer Spr.	
1990	Oak Springs	29,446	5.5	Yearling	Umatilla		Meacham Cr. (mouth)
1991	Oak Springs	30,221	6.2	Yearling	Umatilla	Bonifer Spr.	
1991	Oak Springs	29,325	8.7	Yearling	Umatilla		Meacham Cr. (mouth)
1992	Umatilla	67,435	5.8	Yearling	Umatilla	Bonifer/Minthorn	
1992	Umatilla	64,550	5	Yearling	Umatilla		Meacham Cr. (mouth)
1992	Umatilla	67,419	5.5	Yearling	Umatilla		Meacham Cr. (mouth)

Table 8-47. Percent of Umatilla and non-endemic hatchery returns to Three Mile Falls Dam.

Run Year	Umatilla Hatchery Return to TMFD	% Umatilla Hatchery Return to TMFD	Non-Endemic Hatchery Return to TMFD	Prop Non-Umatilla Hatch. Return to TMFD	Total Hatchery Return To TMFD	Natural Return to TMFD	Total Hat+Nat Return to TMFD
92-93	490	25.6%	126	6.6%	616	1298	1914
93-94	309	24.0%	36	2.8%	345	945	1290
94-95	535	34.9%	122	8.0%	657	874	1531
95-96	664	31.9%	121	5.8%	785	1296	2081
96-97	1288	52.0%	175	7.1%	1463	1014	2477
97-98	725	41.1%	178	10.1%	903	862	1765
98-99	701	37.2%	49	2.6%	750	1135	1885
99-00	690	23.9%	61	2.1%	751	2141	2892
00-01	939	25.6%	164	4.5%	1103	2559	3662
01-02	1585	28.7%	276	5.0%	1861	3658	5519
02-03	816	26.5%	142	4.6%	958	2121	3079
03-04	1088	32.1%	190	5.6%	1278	2111	3389
Mean	**819**	**32.0%**	**137**	**5.4%**	**956**	**1668**	**2624**

Table 8-48. Percent of Umatilla and non-endemic hatchery returns available to spawn in nature.

Brood Year	Umatilla Hatchery Potential Spawners	Umatilla Hatchery Percent of Total Pot. Spawners	Non-Endemic Hatchery Potential Spawners	Non-endemic Hatchery Percent of Total Pot. Spawners	Total Hatchery Potential Spawners	Natural Potential Spawners	Total Potential Spawners
93	345	21.9%	62	3.9%	407	1165	1572
94	204	19.0%	23	2.1%	227	847	1074
95	420	32.4%	95	7.3%	515	783	1298
96	522	28.8%	95	5.2%	617	1194	1811
97	1146	51.7%	155	7.0%	1301	914	2215
98	609	39.8%	149	9.7%	758	771	1529
99	538	33.7%	37	2.3%	575	1020	1595
00	543	20.7%	48	1.8%	591	2030	2621
01	774	23.1%	135	4.0%	909	2444	3353
02	1389	26.9%	241	4.7%	1630	3542	5172
03	688	24.4%	119	4.2%	807	2015	2822
04	942	30.3%	164	5.3%	1106	2003	3109
Mean	**677**	**29.4%**	**110**	**4.8%**	**787**	**1561**	**2348**

Distribution of Hatchery and Natural Adults

In 2003, 70.0% of the summer steelhead available to spawn (fish released above TMFD minus all harvest components) were naturally produced, and during spawning surveys 68.9% of the spawning steelhead identified were natural-origin (Schwartz et al. 2005; Table 8-48).

Adult steelhead were counted at Birch Creek by the Oregon Department of Fish and Wildlife from 1995 to 1999 (DeBano et el. 2004; Table 8-49). The fish were collected in a fish ladder trap on a diversion dam located approximately 1/4 mile downstream of the confluence of the East and West forks of Birch Creek. An estimated 60% of the adult steelhead that pass this location jump over the diversion dam and are not counted in the trap. In 1995-1996, biologists from the Department of Fish and Wildlife conducted a mark/recapture study that led to a total escapement estimate above the trap location of 358 wild and 15 hatchery fish for a total of 373. For that year, this accounted for approximately 30% of the wild fish that were counted at TMFD on the Umatilla. Mark/recapture data in other years was insufficient to make an accurate escapement estimate. A significant proportion of spawners observed on spawning ground surveys from 2001-2004 were hatchery origin (Schwartz et al. 2005; Table 8-50).

Table 8-49. Adult summer steelhead collected at the fish trap on Birch Creek (T. Bailey, Oregon Department of Fish and Wildlife, personal communication, January 2001).

Run Year	Wild	Hatchery	% Hatchery	Total
1995-96	143	6	4	149
1996-97	109	6	5	115
1997-98	85	1	1	86
1998-99	73	0	0	73

Similarity Between Hatchery-Origin and Natural-Origin Fish

Program summer steelhead are derived from unmarked summer steelhead returning to the basin. All hatchery juveniles are released as one-year smolts, compared to natural-origin summer steelhead that emigrate primarily as two-year smolts, with some three and four year old smolts. On a monthly scale, the return timing and relative monthly percent of hatchery and natural steelhead returning overlap closely. No large-scale seasonal separation exists between natural and hatchery steelhead, however Chi-Square and Kolmolgorov-Smirnov tests reveal significant differences between natural and hatchery frequencies on a monthly scale for most years (Chess et al. 2003a). The female to male ratio of natural summer steelhead is higher than hatchery steelhead. Natural female summer steelhead comprised 69.3 ± 1.3% (mean ± SE) of the natural return for return years 1992-93 through 2001-02, whereas hatchery females comprised 57.3 ± 2.3% (mean ± SE) of the hatchery return for the same period (Chess et al. 2003a). Age structure of hatchery and natural steelhead is similar. For run years 1992-93 through 2001-02, natural female summer steelhead were 58.8 ± 4.8% (mean ± SE) one-salt, compared to 57.2 ± 5.1% (mean ± SE) one-salt for hatchery female steelhead (not significantly different: ANOVA, P = 0.82; Chess et al. 2003a). For the same years, natural male steelhead were 68.5 ± 5.1% (mean ±

Table 8-50. Visual observations of natural and hatchery summer steelhead during spawning ground surveys. From Schwartz et al. 2005.

Brood Year	Iskuulpa Creek		NF Meacham Creek		Camp Creek		Boston Canyon Creek		Buckaroo Creek		South Fork Umatilla		Total Observed		Three Mile Dam STS		STS Available To Spawn	
	Nat	Hatch	Nat	Hatch	Nat	Hatch	Nat	Hatch	Nat	Hatch	Nat	Hatch	Nat	Hatch	Nat	Hatch	Nat	Hatch
2001 n=	4	3	4	0	2	0	0	1	5	2	2	0	17	6	2563	1099	2455	905
%=	57.1	42.9	100.0	0.0	100.0	0.0	0.0	100.0	71.4	28.6	100.0	0.0	73.9	26.1	70.0	30.0	73.1	26.9
2002 n=	14	6	2	0	4	3	0	6	3	4	0	0	23	19	3651	1862	3500	1696
%=	70.0	30.0	100.0	0.0	57.1	42.9	0.0	100.0	43.9	57.1	0.0	0.0	54.8	45.2	66.2	33.8	67.4	32.6
2003 n=	17	10	5	0	5	0	0	5	4	0	5	2	36	17	2118	956	2017	865
%=	63.0	37.0	100.0	0.0	100.0	0.0	0.0	100.0	100.0	0.0	71.4	28.6	67.9	32.1	68.9	31.1	70.0	30.0
2004 n=	19	7	3	0	0	0	0	6	2	0	0	0	24	13	2111	1277	2007	1246
%=	73.1	26.9	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	0.0	0.0	64.9	35.1	62.3	37.7	61.7	38.3

SE) one-salt compared to 74.6 ± 4.4% (mean ± SE) of the hatchery male returns (not significantly different: ANOVA, P = 0.37; Chess et al. 2003a).

Smolt releases and acclimation sites

Umatilla hatchery steelhead have always been released as 1 year old smolts, and are currently released at ~4.5 fish per pound (FPP). From the mid 1980s to the present, Bonifer Springs Pond and the Minthorn Springs site have been consistently used for acclimating Umatilla River summer steelhead. Large-grade summer steelhead (pass C) and small-grade steelhead (pass A) were acclimated at Bonifer Springs from brood year 1992 to 1998, excluding 1995 when the small-grade steelhead were acclimated at the Thornhollow site (RM 73.5). Bonifer Springs Pond is located at the confluence of Boston Canyon Creek and Meacham Creek, two miles above the confluence with the main stem Umatilla River at RM 80. Bonifer Springs Pond was used to acclimate steelhead because it is a tributary of Meacham Creek, which was identified as a major component of the available summer steelhead habitat in the Umatilla River Basin (CTUIR and ODFW 1990), and was targeted for steelhead supplementation. Large-grade steelhead (pass B) were acclimated at the Minthorn Springs site from brood year 1992 to 1998. The Minthorn Springs site is located at RM 64.5 of the mainstem Umatilla River. Minthorn Springs is a large spring system connected to the Umatilla River and floodplain. For brood years 1999 to 2001, small-grade (pass A) steelhead were no longer acclimated at Bonifer Springs, instead smalls were acclimated at Minthorn Springs following acclimation and release of the large-grade steelhead (pass C). The second group of large–grade steelhead (pass B) were acclimated at Bonifer Springs Pond. In an effort to increase smolt survival, co-managers decided to release some steelhead from Pendleton (RM 56), the most downstream acclimation site in the subbasin. From 2002 to present, ungraded steelhead were released in approximately equal numbers (approx. 30,000-50,000 ea.) from the Pendleton and Minthorn acclimation facilities, and direct stream released in Boston Canyon Creek near Bonifer Springs. Acclimated fish are held in ponds for 2-3 weeks, then allowed to volitionally migrate for one week, then forced out of the ponds. Direct stream releases are made when acclimated fish are forced from the ponds.

Juvenile migration timing

Natural and hatchery steelhead show similar trends in outmigration timing, except for the earlier migration of natural fish (Chess et al. 2003a; Figure 8-20). Hatchery steelhead were released from acclimation sites in early and late April. The early release groups were the large-grade steelhead from passes B and C. Small-grade steelhead were reared an extra month in the hatchery, acclimated and released a month later than the large-grade steelhead. If the hatchery steelhead migrated out of the Umatilla River basin soon after release, then a distinct, bimodal distribution of hatchery outmigrants would be produced. This was the case for three of four years. The 1999 outmigrant year was skewed, but unimodal for hatchery steelhead. Natural steelhead started migration earlier than the earliest release hatchery steelhead release date in all four years. A small percentage of natural and hatchery steelhead migrate into late May and early June. Natural and hatchery outmigrants are being detected at Three Mile Falls Dam during rising and falling limbs of the hydrograph.

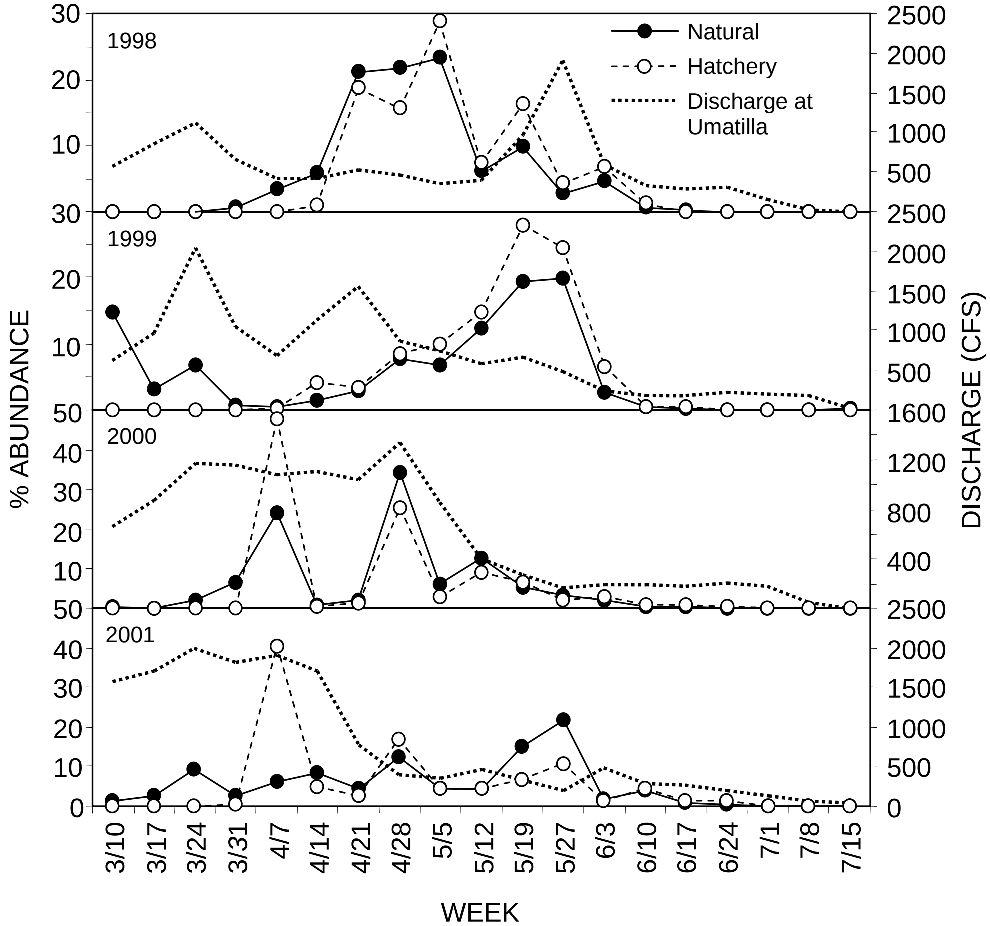


Figure 8-20. Migration timing of natural and hatchery summer steelhead smolts counted at Three Mile Falls Dam. The percentages were from weekly totals of fish divided by the respective total for the outmigration period. Daily Flow data at the lower Umatilla River gauge (RM 2.1) was averaged on a weekly interval. From Chess et al. 2003a.

Residualism

Small-grade steelhead exhibited lower PIT tag detections at TMFD and lower smolt-to-adult survival, suggesting they either had lower outmigration survival or they were residualizing in the Umatilla River (Chess et al. 2003b). There was evidence that small-grade steelhead residualized and did not migrate until the second or third year following acclimation. Only 3 of 20 radio-tagged, small-grade steelhead migrated out of the basin after release from the outlet of Bonifer Springs (Stonecypher et al. 2001). Several detections of small-grade steelhead, PIT-tagged two years earlier have occurred at TMFD (White et al. 2003), confirming delayed outmigration of the small-grade production. Contor et al. (1995) estimated 1,100 hatchery steelhead residualized in Boston Canyon Creek, and found evidence of displacement of natural steelhead in the stream. Approximately 4,000 hatchery steelhead residualize each year in Boston Canyon, Meacham, Minthorn Springs creeks, and in the main stem of the Umatilla River (Contor et al. 1995). This estimate was 2.5% to 3.3% of the total steelhead released per year in the Umatilla River. There is evidence that many residual steelhead move into the lower Umatilla River. In recent years, anglers reported catching adipose and ventral fin clipped "trout" in the Stanfield area (RM 32). Summer steelhead are no longer size graded, all are released at approximately 4.5 FPP.

Other fish releases in the Umatilla Subbasin

Besides summer steelhead, coho salmon and spring and fall Chinook salmon are also released in the Umatilla River annually. Approximately 810,000 spring Chinook salmon are released annually, 600,000 from Umatilla hatchery and an additional 210,000 from Little White Salmon Hatchery (LWSH). All spring Chinook salmon are acclimated at the Imeques acclimation facility (RM 80). Fish raised at Umatilla Hatchery are transferred in fall or winter and released in mid-March at 12 FPP, whereas steelhead raised at LWSH are transferred to the acclimation site in mid-March and released in mid-April at 15 FPP. Approximately 1.5 million coho salmon are released in the Umatilla River annually. All coho salmon are acclimated at the Pendleton acclimation facility and released at 15 FPP. Half (~750,000) are transferred to the acclimation site in mid-February and released in mid-March and the other half are transferred in Mid-March and released in mid-April. Approximately 1.08 million fall Chinook salmon are released in the Umatilla River annually, of which 600,000 are subyearlings and 480,000 are yearlings. Half of the subyearlings (~300,000) are transferred to the Thornhollow acclimation site (RM 73.5) in early May and released in late May at 50 FPP, whereas the other half are direct stream released at Umatilla RM 49 in late May at 35 FPP. All yearling fall Chinook salmon are acclimated and released from the Thornhollow acclimation facility at 10 FPP. One half (240,000) are transferred in mid-February and released in mid-March, while the second half is transferred in mid-March and released mid-April.

Program Performance

The stray rate for program summer steelhead has not been estimated. The mean smolt-to-adult survival rate for brood years 1991-97 was 0.42% (small grade range: 0.03-0.21; large grade range: 0.02-1.52; Chess et al. 2003a). The annual return of summer steelhead to TMFD averaged 819 for the 1992-93 through 2003-04 run years (Table 8-47). Natural-origin summer steelhead returns for the same period averaged 1,668 annually. Harvest has not met expectations, with fewer than 100 steelhead caught annually from 1994 to 1999 (Chess et al. 2003a). However, an estimated 114 steehead were caught in 2000-01 and an estimated 278 were caught in 2001-02 (Chess et al. 2003b).

Potential Limiting Factors Influencing Viability

The net effect of this program is unknown, but the number of naturally spawning adults has increased (Table 8-48). Almost 30% of steelhead available to spawn naturally originate from the Umatilla Hatchery. The use of natural-origin steelhead for broodstock should reduce the potential for divergence of the hatchery-origin summer steelhead from the natural-origin population. However, another 5% of naturally spawning steelhead are non-endemic hatchery fish that stray into the Umatilla River and are passed at TMFD due to the inability to identify and remove out-of-basin hatchery adults. The rate of fall-back for these fish is not known, and there is the potential that these may not be able to pass downstream of TMFD. Smolt releases occur during the normal migration period of natural steelhead, and it appears that most fish emigrate soon after release. However, there is evidence that some smolts residualize and remain in the Umatilla River another year. These fish may compete with naturally spawned fish for habitat and prey resources.

8.4.4. Walla Walla River Steelhead

Lyons Ferry Hatchery Mainstem Walla Walla River Summer Steelhead Program

The hatchery summer steelhead program for the mainstem Walla Walla River was initiated in 1982 as part of a larger regional effort guided by the Lower Snake River Compensation Plan authorized by Congress in 1976 (Water Resources Development Act of 1976, Public Law 94-587). The primary management objectives for this program are to provide adult returns for harvest while minimizing impacts and interactions with natural fish.

Broodstock collection, spawning, incubation, and juvenile rearing for this program are conducted at Lyons Ferry Hatchery (LFH). Well water (52^{o}F) is the source for all facets of the hatchery production. The hatchery is operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, INAD, and MDFWP.

The LFH Stock program utilizes a non-endemic steelhead hatchery stock originally developed from Wells Hatchery (Wells Stock) on the upper Columbia River. Other steelhead stocks were also used in the past to fulfill production needs (Wallowa, Pahsimeroi, Oxbow, and Ringold stocks). Hatchery origin adults (mainly Wells and Wallowa stocks) were later trapped on site at LFH to build LFH stock summer steelhead.

Broodstock Source, Collection and Spawning

Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken. Annual broodstock collections goals for all LFH stock summer steelhead production programs are 360 adult hatchery returns. Additional fish may be collected to account for pre-spawning loss and incidence of IHNV in egg lots that are destroyed. Adults are spawned two males per female. Eggs are incubated without temperature regulation. Average eggs/female is about 4,750 eggs. Fry are ponded in indoor rearing tanks, then moved to standard outdoor raceways.

Survival and Distribution

Survival data collected to date indicates 89% survival from green egg to fry, and 68% survival from fry to smolt. Currently, about 100,000 smolts of the 345,000 total LFH Stock fish produced annually are released into the lower Walla Walla River from LFH. Releases were greater in the past (Table 8-51), but have been reduced because of ESA concerns. Currently, smolts are direct stream released at a size of 4-5 fish/lb at RM 35 between April 15-25.

Adult fish enumeration at Nursery Bridge Dam located above the smolt release site in Milton-Freewater indicated a low percentage of hatchery steelhead returns migrate to upstream spawning areas in the Walla Walla River. Table 8-52 presents the numbers of hatchery and natural origin summer steelhead counted at Nursery Bridge Dam from brood years 1993-2005. Although the overall number of hatchery strays is low there appears to be an increasing trend.

Table 8-51. Release of LFH, Wallowa, Wells and Ringold stock steelhead smolts into the Walla Walla River, 1983-2005 release years.

Release Year	Stock	River Mile	Number of smolts
1983	Wells	28	91,260
1984	Wells	35	133,235
1985	Wells	35,40	115,200
1986	Wells	30,32,35	138,845
1987	Wells, LFH	30,32,35	124,973
1988	LFH	22,24,25,27	181,166
1989	LFH,	22,24,25,27	106,140
1990	Wallowa	22,24,25,27	130,217
1991	Ringold	23,25,26,27	198,749
1992	LFH	NA	75,210
1993	LFH	35,36	83,240
1994	LFH	23,24,25,27,30,34,35	159,905
1995	LFH	30,34,35,36	158,875
1996	LFH	30,35	170,000
1997	LFH	30,35	170,980
1998	LFH	30,35	165,855
1999	LFH	35	176,000
2000	LFH	35	165,500
2001	LFH	35	103,980
2002	LFH	35	99,859
2003	LFH	35	102,975
2004	LFH	35	80,143
2005	LFH	35	10,4027

Table 8-52. Estimated numbers of adult hatchery and natural origin summer steelhead passing upstream of Nursery Bridge Dam from brood years 1993-2005.

Brood Year	Hatchery Steelhead	Natural Steelhead	Percent Hatchery
1993	4	1695	0.2%
1994	2	1113	0.2%
1995	10	894	1.1%
1996	15	745	2.0%
1997	10	607	1.6%
1998	6	786	0.8%
1999	2	580	0.3%
2000	27	1069	2.5%
2001	75	1548	4.6%
2002	89	2417	3.6%
2003	46	1252	3.5%
2004	NA	NA	NA
2005	15	374	3.9%
Mean	**25**	**1,090**	**2.2%**

Section 9 Near-Term and Long-Term Management Actions

9.1 Strategic Guidance for Prioritizing Management Actions

Achieving recovery for the Mid-Columbia River steelhead ESU will depend on restoring the viability of extant populations in major population groups to levels that support the proper functioning of the ESU. This will require intensive effort by individuals at the regional, watershed and local levels.

The purpose of this strategic framework is to provide guidance for prioritizing management actions to recover Mid-Columbia River steelhead populations. It recognizes that reversing the decline of key populations, life histories, and habitats requires use of well-formulated scientifically sound approaches. Since multiple causes are responsible for impaired population viability and disrupted ecosystem function, limiting factors and threats throughout the entire life cycle will need to be addressed in concert. Efforts must also be focused to protect and enhance populations and areas that are critical to achieving ESU recovery.

As part of this planning process, management actions and strategies are being developed at multiple levels including tributaries, watersheds, and the Columbia River mainstem to achieve recovery of local populations. This strategic framework does not replace the actions identified for recovery of individual watersheds. Instead, it will be used as strategic guidance for where, when, and how factors and threats limiting viability of extant and extirpated Mid-Columbia steelhead populations are addressed.

Prioritization Considerations

The following considerations will be used as guidance for the implementation of management strategies and actions for recovery of Mid-Columbia River steelhead populations in Oregon. All proposed actions must be based on and supported by the best available scientific knowledge.

1. The following actions will be considered high priority:

- Actions that provide long-term protection for the major life history strategies (i.e. summer and winter run timing) that currently exist at the MPG level.
- Actions that provide long-term protection of habitat conditions that support the viability of priority extant populations and their primary life history strategies throughout their entire life cycle. A population is considered a priority if it is critical for MPG or ESU viability.
- Actions that enhance the viability of priority extant populations.
- Actions that protect or enhance viability of multiple listed populations.
- Actions that enhance habitat and restore natural processes to increase survival, connectivity and reproductive success of priority extant populations.
- Actions that target the key limiting factors and that contribute the most to closing the gap between current status and desired future status of priority populations.

- Actions that are required to protect and enhance habitats for populations that are not critical for MPG or ESU viability but must be maintained.

2. Other things being equal, actions that demonstrate the following have high priority:

- Actions where opportunity for success is high (rather than those of limited feasibility).
- Actions that are complementary to other land management, water quality, environmental management and recreational objectives as specified in fish management, conservation, recovery or other plans developed with and supported by subbasin stakeholders (rather than those that are isolated, stand-alone efforts).
- Actions that have landowner support and participation.
- Actions that demonstrate cost effectiveness relative to alternative means of achieving the same objectives.

Section 10 Cost Effectiveness

Section will be completed in 2006.

Section 11 Preferred Management Scenarios

Section will be completed in 2006.

Section 12 Implementation and Adaptive Management Framework

Section will be completed in 2006.

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